# *United States Court of Appeals*
# *for the*
# *District of Columbia Circuit*

# TRANSCRIPT OF RECORD

FOR MR. JUSTICE VAN ORSDEL.

# TRANSCRIPT OF RECORD.

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## Court of Appeals of the District of Columbia.

**OCTOBER TERM, 1918.**

**No. 3156.** 492

HUTCHISON VAPOR HEATING CORPORATION AND
GEORGE H. ZELLERS, TRADING AS ZELLERS & CO.,
APPELLANTS,

*vs.*

THOMAS G. MOUAT.

APPEAL FROM THE SUPREME COURT OF THE DISTRICT OF
COLUMBIA.

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**FILED FEBRUARY 11, 1918.**

**PRINTED JUNE 19, 1918.**

Argued Dec. 6/918.

# Court of Appeals of the District of Columbia.

No. 3156.

HUTCHISON VAPOR HEATING CORPORATION ET AL., Appellants,

vs.

THOMAS G. MOUAT.

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a Supreme Court of the District of Columbia.

In Equity. No. 33962.

THOMAS G. MOUAT, Plaintiff,

vs.

HUTCHISON VAPOR HEATING CORPORATION and GEORGE H. ZELLERS,
Trading as ZELLERS & Co., Defendants.

UNITED STATES OF AMERICA,
*District of Columbia, ss:*

Be it remembered, that in the Supreme Court of the District of Columbia, at the City of Washington, in said District, at the times hereinafter mentioned, the following papers were filed and proceedings had, in the above-entitled cause, to wit:—

1 *Bill of Complaint.*

Filed December 13, 1915.

Supreme Court of the District of Columbia.

In Equity. No. 33962.

THOS. G. MOUAT, Plaintiff,

vs.

HUTCHISON VAPOR HEATING CORPORATION and GEORGE H. ZELLERS,
Trading as ZELLERS & Co., Defendants.

To the Honorable the Judges of the Supreme Court of the District of Columbia, United States of America:

Thomas G. Mouat, a citizen and resident of the township of Bratenahl, in the County of Cuyahoga and State of Ohio, plaintiff, brings this his Bill of Complaint against Hutchison Vapor Heating Corporation, being as your orator is informed and believes a Virginia corporation, having its principal office and place of business at Washington in the District of Columbia, and also against George H. Zellers, being as your orator is informed and believes a citizen and inhabitant of the District of Columbia, and trading and doing business under the name and style of Zellers & Co. in said District of Columbia, in which district the acts of infringement hereinafter complained of were committed.

And thereupon your orator complains and says:

1. That prior to the 30th day of April, 1909, your orator was the true, original, first and sole inventor of certain new and useful improvements in Pressure Regulating Apparatus, which were not known or used by others in this country before his invention or discovery thereof, and not patented or described in any printed publication of this or any foreign country before his invention or
2 discovery thereof nor more than two years prior to said 30th
day of April, 1909, and not patented in any country foreign to the United States on an application filed more than twelve months prior to said 30th day of April, 1909, and not in public use or on sale in this country for more than two years prior to said 30th day of April, 1909; and that on said 30th day of April, 1909, your orator did make application for Letters Patent of the United States upon said improvements in Pressure Regulating Apparatus, and having fully complied with the law in such cases made and provided, and being in all respects within the requirements of the Statutes relating thereto, Letters Patent of the United States, No. 937,686, were granted to your orator on or about the 19th day of October, 1909, whereby there was secured to your orator, his successors, legal representatives and assigns for the term of seventeen years, the full and exclusive right and privilege of making, using, and vending his said invention or improvement as fully set forth and claimed in and under the aforesaid Letters Patent.

2. That a description of the improvement covered in said Letters Patent was given in the specification forming a part of and annexed to the Letters Patent, and that said Letters Patent and specification (which, or an exemplified copy of which, your orator will produce as your Honors may direct) was duly recorded in the United States Patent Office in books kept for that purpose. A copy of said specification is herewith filed as an Exhibit and is to be taken as a part hereof.

3. That by virtue of the premises your orator became and now is vested with the exclusive right, title and privilege in and to the said inventions and improvements and in and to the said Letters Patent of the United States, No. 937,686, to and through-
3 out the United States and the territories thereof, to own and
to have the right to recover and receive to his own use any and all damages, profits, savings and advantages resulting from or growing out of the use of the said inventions or improvements, or which have accrued by reason of the infringement of the said Letters Patent.

4. That ever since the issuance of the said Letters Patent, No. 937,686, your orator has been and but for the herein described infringements thereof would still be in undisputed possession, use, and enjoyment of the inventions or improvements set forth and described in the said Letters Patent and all and singular the exclusive rights and privileges conferred thereby and of all benefits, profits and advantages accruing therefrom.

5. That your orator verily believes himself to have been the original, first, and sole inventor and discoverer of the inventions and improvements described and claimed in said Letters Patent, No. 937,686, and particularly in claims 7 and 10 thereof; and that the said Letters Patent are and will hereafter be of great and increasing value to your orator in case he is protected in the exclusive enjoyment thereof and of the rights conferred thereby, and particularly by claims 7 and 10 thereof, as he verily believes that in law and in equity he is entitled to be.

6. That ever since the date of issuance to your orator of said Letters Patent, No. 937,686, your orator has been and now is vested with the sole and exclusive right, title and interest in and to the said Letters Patent and in and to the inventions therein described and claimed, and is vested with the sole and exclusive right to institute suits against infringers of your orator's exclusive rights under
4 the said Letters Patent.

7. That Hutchison Vapor Heating Corporation, and George H. Zellers trading as Zellers & Co., the defendants herein, subsequent to the date of issuance of your orator's said Letters Patent and within six years prior to the filing of this, your orator's Bill of Complaint, were and now are engaged in the business of manufacturing, selling, and dealing in Pressure Regulating Apparatus and in parts and members constructed and designed and adapted and intended for use in connection with Pressure Regulating Apparatus, and in the construction and installation of Heating Systems containing and including Pressure Regulating Apparatus embodying and containing the inventions described and claimed in the Letters Patent aforesaid, and particularly in claims 7 and 10 thereof, without leave from your orator and in violation of your orator's protests, and in the infringement of your orator's Letters Patent aforesaid, and particularly of claims 7 and 10 thereof; that said Pressure Regulating Apparatus, or the parts thereof, as your orator is informed and believes and therefore charges the fact to be, were and are manufactured in the District of Columbia and in the State of Virginia and were and are sold and used in various parts of the United States, including the District of Columbia, in violation of your orator's rights, and the defendants threaten to continue in the future to manufacture, use, and sell the said infringing devices to the great damage and injury of your orator in the premises.

8. Your orator further shows that he first learned of the commission of the infringing acts herein complained of in the spring of 1915, to wit in March 1915; that since that date he has repeatedly

directed letters to the first named defendant, Hutchison
5 Vapor Heating Corporation, calling attention to your orator's rights in the premises and warning said defendant against continuing the infringing acts here complained of; that said Hutchison Vapor Heating Corporation has refused to desist from its infringing acts, but has sought to obtain a license from your orator and has offered the sum of Three Thousand Dollars ($3,000.00) therefor to be paid upon an installment plan, but has been unwilling to accede to your orator's wishes in matters which your orator considers necessary to his own proper protection; whereby your orator has been forced to file this bill of complaint as the only means whereby he may obtain relief and be permitted to enjoy the rights vested in him under and by virtue of the issuance of the Letters Patent aforesaid.

9. That your orator further shows that he has never granted any licenses or manufacturing rights under the aforesaid Letters Patent but that he and The Mouat Squires Company with which he is associated have together supplied the trade promptly and efficiently with the patented devices; that said The Mouat Squires Company is an Ohio corporation with a large paid in capitalization, to wit, $15,000.00, and is located at Cleveland, Ohio; that your orator and said corporation also have agencies at Canton, Ohio; Columbus, Ohio; Chillicothe, Ohio; Dayton, Ohio; Delphos, Ohio; Elyria, Ohio; Fostoria, Ohio; Lima, Ohio; Sandusky, Ohio; Toledo, Ohio; Appleton, Wisconsin; Chicago, Illinois; Decatur, Indiana; Fort Wayne, Indiana; Vincennes, Indiana; Holyoke, Massachusetts; Iowa City, Iowa; and Ithaca, New York; and your orator and said corporation continually maintain a force of traveling salesmen upon the road visiting localities in which no agencies are maintained; and
6 your orator shows that his said patent rights are so well known and so acknowledged and respected that this is the first instance of an invasion thereof which has ever come to his knowledge.

10. Your orator further shows that all of the Pressure Regulating Apparatus and the systems containing and including said Pressure Regulating Apparatus heretofore manufactured and sold by him or under his control or direction have been marked "Patented" together with the date "October 19, 1909" in accordance with the Statutes in such cases made and provided.

11. That great and irreparable injury and damage have resulted to your orator from the infringement of the said Letters Patent No. 937,686, and particularly of claims 7 and 10 thereof, and that great gains and profits have accrued to the defendant herein from the infringement of the said Letters Patent and particularly claims 7 and 10 in violation of your orator's rights, the full amount of which is unknown to your orator, but which in equity belong to him and should be accounted for by the said defendants and paid over to your orator as the avails of his exclusive rights aforesaid, and the profits and gains which your orator would have derived but for the unlawful acts of the defendants aforesaid; your orator alleges and charges the fact to be that the amount of the said profits and damages accrued to the said defendants and suffered by your orator exceeds the

sum of Five Thousand Dollars ($5,000.00) exclusive of costs, although as already said, your orator is unable to state, without an accounting and disclosure, the full amount of such profits and damages; and that your orator has reason to believe and fear, and does believe and fear that he will continue to suffer great and irreparable loss and damage unless the said defendant be restrained from
7 further infringement of the said Letters Patent, and particularly of claims 7 and 10 thereof.

12. Your orator shows that the defendants have produced and are producing and selling a large number of the infringing devices; that the device manufactured by the defendants is of cheaper and lighter construction than that which your orator has felt justified in placing on the market, and that defendants have quoted and are quoting prices lower than it is possible for your orator to meet without cheapening his own product; that the defendants are undercutting and disturbing the market; that your orator is informed and believes and hence avers that Hutchison Vapor Heating Corporation, defendant, sells its infringing Pressure Regulators freely and cheaply to all who will buy, whereas your orator sells and installs his own Pressure Regulating Apparatus as described and claimed in the Letters Patent aforesaid and particularly in claims 7 and 10 thereof, only in connection with valves, parts and fittings necessary to the construction of a complete vapor heating system; whereby the aforesaid Letters Patent are peculiarly valuable and important to your orator and the mode of infringement herein complained of is particularly detrimental.

13. That your orator has no adequate remedy in the premises, save in this Court of Equity, where matters of this nature are properly cognizable.

Your Orator Therefore Prays:

A. That the said defendants, Hutchison Vapor Heating Corporation and George H. Zellers, trading as Zellers & Co., according to the best and utmost of their knowledge, remembrance, information and belief, shall make to the matters and things hereinbefore
8 stated and charged full, true, direct and perfect answer, not, however, under oath which is hereby waived.

B. That the said defendants may be required to answer under oath the following interrogatories:

1. Did or did not you or either of you supply and install Pressure Regulating Apparatus similar to that illustrated and described in the accompanying leaflet and marked "Exhibit B" at the place of business of George H. Zellers trading as Zellers & Co., 1331 Fourteenth St., N. W., Washington, D. C., prior to the filing of this bill of complaint and within six years before the date thereof?

2. Did or did not you or either of you supply and install in connection with a steam heating system of Pressure Regulating Apparatus conforming substantially to that illustrated and described in the leaflet attached hereto and marked "Exhibit B" at the residence of Clara de N. Abercrombie, 1309 Twentieth St., N. W., Washington, D. C., prior to the filing of this bill of complaint and less than six years prior to the date thereof?

3. Did or did not you or either of you supply and install in connection with a steam heating system a Pressure Regulating Apparatus conforming substantially to that illustrated and described in the leaflet attached hereto and marked "Exhibit B" at the residence of —— Bennett, 23 Eighth St. S. E., Washington, D. C., prior to the filing of this bill of complaint and less than six years prior to the date thereof?

4. Did or did not you or either of you supply and install in connection with a steam heating system a Pressure Regulating Apparatus conforming substantially to that illustrated and described in the leaflet attached hereto and marked "Exhibit B" at the residence of Robert I. Garber, 25 Eighth St. S. E., Washington, D. C., prior to the filing of this bill of complaint and less than six years prior to the date thereof?

5. Did or did not you or either of you supply and install in connection with a steam heating system a Pressure Regulating Apparatus conforming substantially to that illustrated and described in the leaflet attached hereto and marked "Exhibit B" at the residence of A. E. H. Middleton, 223 A St., S. E., Washington, D. C., prior to the filing of this bill of complaint and less than six years prior to the date thereof?

6. Did or did not you or either of you supply and install in connection with a steam heating system a Pressure Regulating Apparatus conforming substantially to that illustrated and described in the leaflet attached hereto and marked "Exhibit B" at the 9 National Savings & Trust Company, corner Fifteenth Street and New York Avenue, N. W., Washington, D. C., prior to the filing of this bill of complaint and less than six years prior to the date thereof?

7. Is it not a fact that you have issued and distributed various catalogues and leaflets illustrating and describing the "Hutchison Vapor Heating System", so called, and the particular Pressure Regulating Apparatus employed, such illustrations bearing the words "Patents Pending"?

8. State whether any application or applications for U. S. Letters Patent upon the Pressure Regulating Apparatus so illustrated is or are in fact pending in the U. S. Patent Office.

9. If your answer to the preceding question is to the effect that Letters Patent have been applied for, give a list of the allowed claims and of all references cited in such application or applications.

10. State whether the letter attached hereto and marked "Exhibit C" and signed "Sturtevant and Mason" is authentic and whether Sturtevant and Mason were duly authorized to offer the sum of $3000.00 in yearly instalments of $300.00 for a license under the patent in suit?

C. That the said defendants may be decreed to account for and pay to your orator the profits or income thus unlawfully derived from the violation of your orator's rights and the damage unlawfully inflicted upon your orator by reason of the unlawful invasion of your orator's rights, and that upon the entering of the decree against the defendants your Honors may increase the actual damage so assessed

10. The combination, with a boiler and means for heating the same, of means for maintaining substantially constant the pressure of steam generated by said boiler, said means comprising a receptacle extending above the water line of the boiler, a pipe connecting said receptacle with the boiler and extending above the bottom of said receptacle, a pipe connecting said receptacle with the steam space of the boiler and arranged to drain toward said receptacle, a movably supported receptacle communicating with the former receptacle and arranged to drain into the former receptacle, and connections between the latter receptacle and the means for heating the boiler.

11. The combination, with a boiler and furnace, of means for maintaining substantially constant the pressure of the steam generated by said boiler, said means comprising a receptacle extending above the level of water in the boiler and provided with a connection extending from between the top and bottom thereof and the water space in the boiler, a pipe connecting said receptacle with the steam space in the boiler, a lever pivoted intermediate of its ends at a point as high as the level of the liquid in said receptacle, said lever having a hollow arm extending from the pivotal portion thereof, a receptacle on said arm and communicating therewith, means connecting the first mentioned receptacle and the pivotal portion of the lever, a stop for limiting the downward movement of the lever arm which carries the second receptacle, and connections extending from the opposite arms of said lever and arranged to control the combustion in the furnace.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

THOMAS G. MOUAT.

Witnesses:
J. B. Hull,
Brennan B. West.

the said dampers for opening the latter by reverse movements of the second receptacle.

3. The combination, with a boiler and furnace, of means for maintaining substantially constant pressure of the steam generated by said boiler, said means comprising a receptacle provided with a connection extending from between the top and bottom thereof to the water space in the boiler, a pipe connecting said receptacle with the steam space in the boiler, a lever pivoted intermediate of its ends at a point as high as the level of the liquid in said receptacle, said lever having a hollow arm extending from the pivotal portion thereof, a receptacle on said arm and communicating therewith, a flexible connection extending between the first mentioned receptacle and the pivotal point of the lever, stops for limiting the movements of said lever, and connections extending from the opposite arms of said lever and arranged to control the combustion in the furnace.

4. The combination, with a boiler and furnace, of means for maintaining substantially constant the pressure of steam generated by said boiler, said means comprising a receptacle arranged externally of said boiler and extending above the level of water therein, a pipe connecting said receptacle with the water space of the boiler and arranged to maintain a maximum level in said receptacle, a second pipe connecting said receptacle with the steam space in the boiler, a bracket carried by said receptacle and having a pivot support and adjustable stops arranged on opposite sides of said support, a lever, a pipe section supporting said lever and supported by said pivot support, a flexible connection between said section and said receptacle, one of the arms of said lever being hollow and communicating with said pipe section, a receptacle carried by said hollow arm, and connections extending from the opposite arms of the lever and adapted to control the heating effect of the furnace upon the boiler.

5. The combination, with a boiler, of means for maintaining substantially constant the pressure of steam generated by said boiler, said means comprising a receptacle having its upper end above the level of liquid in the boiler, a pipe connecting said receptacle with the water space in the boiler and having a check valve therein, said pipe being arranged to maintain a maximum level of liquid in said receptacle, a pipe connecting the upper portion of said receptacle with the steam space of the boiler, a second receptacle, connections between said receptacles, and means operated by the movement of the latter receptacle for controlling the heat imparted to the boiler to generate steam therein.

6. The combination, with a boiler and means for heating the same, of means for maintaining substantially constant the pressure of steam generated thereby, said means comprising a receptacle, a pipe connecting said receptacle with the water space in the boiler and extending above the bottom of said receptacle, a pipe connecting the upper portion of said receptacle with the steam space of the boiler and arranged to drain toward said receptacle, a movably supported receptacle communicating with the former receptacle and having a vent opening, a valve in the last mentioned pipe arranged to admit air thereto on the fall of pressure in said pipe, and connections between the latter receptacle and the means for heating said boiler.

7. The combination, with a boiler and means for heating the same, of means for maintaining substantially constant the pressure of steam generated thereby, said means comprising a receptacle, a pipe connecting said receptacle with the water space in the boiler and extending above the bottom of said receptacle, a pipe connecting the upper portion of said receptacle with the steam space of the boiler and arranged to drain toward said receptacle, a movably supported receptacle communicating with the former receptacle, and connections between said receptacle and the means for heating said boiler.

8. The combination, with a boiler and means for heating the same, of means for controlling said heating means, the latter means comprising a re eptacle, a bracket, bearings carried by said bracket and receptacle, a pair of adjustable stops located on opposite sides of said bearings, a lever pivoted intermediate of its ends in said bearings, one arm of said lever comprising a pipe, a supply pipe arm communicating with said receptacle and said pipe, a second receptacle carried by said pivoted pipe, means dependent upon the pressure of steam in the boiler for supplying liquid from the first receptacle through the flexible pipe, and connections between the second receptacle and the *heating means*.

9. The combination, with a boiler and means for heating the same, of means for controlling said heating means, the latter means comprising a receptacle, a pipe connecting said receptacle with the water space of said boiler and adapted to convey liquid from said receptacle to said boiler, a second pipe communicating with the steam space of the boiler and with said receptacle, a bracket projecting from said receptacle, a yoke supported by said bracket and vertically adjustable with respect thereto, a lever pivoted to said yoke, a receptacle carried by said lever, a connection between said receptacles, and a connection between the second receptacle and the boiler heating means.

Mouat's invention.

The receptacle 21 is provided with a vent opening 26 with a guide strap 27 extending across and above the same, said strap being provided with a perforation for a stem 28 having thereon a valve 29 adapted to close the orifice 26, said valve and stem being operated by means of a float 30 to which the stem is connected.

From the bottom of receptacle 6 there projects a supply connection 31 having an elbow 32 provided with a valve, the stem of which is shown at 33.

34 denotes a flexible pipe which connects the elbow 32 with the cross fitting 18.

The arm 20 of the lever is connected with the damper 2 by means of a chain 35, while the opposite arm 22 is connected to the check draft damper 4 by means of a chain 36, the latter arm having a plurality of apertures 22ᵃ by means of which the point of connection of the chain 36 therewith may be varied.

With the parts arranged as described, the operation will be as follows: When the pressure within the boiler is at or below that which it is desired to maintain therein and in the system connected therewith, the lever will be in the position shown in dotted lines in Fig. 1; that is to say, with the receptacle 21 elevated and the weighted arm of the lever depressed, which will cause the air damper 2 to be opened and the check damper 4 to be closed. Should the pressure within the boiler exceed that which it is desired to maintain therein or in the system or apparatus connected therewith, this pressure acting through pipe 11 will force water from the receptacle 6 into the receptacle 21, causing said receptacle to fall to the position shown in full lines in Fig. 1; that is to say, until the pipe arm 20 engages the stop 25ᵃ. This stop will be so adjusted as to engage the arm 20 when the latter is approximately in a horizontal position. This movement of the lever will cause the check damper 4 to be opened and the air damper 2 to be closed. The provision of the flexible pipe 34 allows of the oscillation of the lever comprising the arms 20 and 22 without affecting the connections therewith. When the pressure within the boiler falls below normal, water is drained completely from the receptacle 21, (the pivot for arm 20 being above the point of connection of pipe 9 with the receptacle 6) and a reverse operation of dampers 2 and 4 occurs.

It will be understood that, in first putting the apparatus into operation, it will be necessary to fill the receptacle 6 through the filling aperture. Should the pressure in the boiler increase, notwithstanding the operation of the dampers 2 and 4, the float 30 and valve 29 will prevent the receptacle 21 from overflowing.

In order to prevent the necessity for refilling the receptacle 6, the pipe 11 slopes downwardly from the boiler toward the receptacle, thereby causing water of condensation to drain into said receptacle and maintain the maximum level therein. Any surplus water can run into the boiler through the pipe 9, its return into the receptacle 6 being prevented by means of the check valve 10.

As the liquid in the receptacle 6 is exposed to atmospheric pressure, through receptacle 21 and vent 26, it is necessary to provide against the emptying of said receptacle into the boiler in case the pressure in the boiler should fall below that of the atmosphere. I accordingly provide a valve 37 in the pipe 11, which valve may be conveniently located near the bend, said valve being arranged to open at approximately and preferably slightly below atmospheric pressure, whereby it will be impossible for the water in the tank 6 to flow back into the boiler through pipe 11. A gage 38 carried by the receptacle 6 serves to indicate the level of the liquid therein and the pressure of the steam in the boiler.

Among the advantages of the intermediate receptacle 6 is the fact that it avoids the necessity for using water from the boiler to operate the receptacle 21.

Having thus described my invention, what I claim is:

1. The combination, with a boiler and means for heating the same, of means for controlling said heating means, the latter means comprising a receptacle, a connection between said receptacle and the water space of the boiler, a second connection between said receptacle and the steam space of the boiler, a lever pivoted intermediate of its ends and comprising a supply pipe, a receptacle supported by the lever and communicating with the supply pipe, a flexible connection extending between said supply pipe and the first mentioned receptacle, means for limiting the movement of the supply pipe and receptacle, and connections operative by the movement of the latter receptacle for varying the pressure of the steam generated by the boiler.

2. The combination, with a boiler and means for heating the same, said means comprising an air damper and a check damper, of means for automatically operating said dampers in reverse directions, the latter means comprising a receptacle, a connection between said receptacle and the steam space in the boiler, a drain connection extending between said receptacle and the water space of the boiler and provided with a check valve adapted to open toward the boiler, a lever pivoted intermediate of its ends and having one arm provided with a receptable, connections for supplying liquid from the former receptacle to the latter receptacle, and connections between the lever arms and

# UNITED STATES PATENT OFFICE.

THOMAS G. MOUAT, OF BRATENAHL, OHIO.

## PRESSURE-REGULATING APPARATUS.

937,686. Specification of Letters Patent. Patented Oct. 19, 1909.
Application filed April 30, 1909. Serial No. 493,117.

*To all whom it may concern:*

Be it known that I, Thomas G. Mouat, a citizen of the United States, residing at Bratenahl, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Pressure-Regulating Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to apparatus for maintaining substantially constant the pressure and temperature of fluids, and is especially adapted for use in connection with low-pressure steam-heating systems.

It has for an object to provide an apparatus of this character which, while being extremely simple of construction, is efficient and reliable in operation.

Generally speaking, the invention may be defined as consisting of the combinations of elements embodied in the claims hereto annexed and illustrated in one exemplification in the drawings forming part hereof, in which—

Figure 1 represents a side elevation of a steam boiler furnace having my apparatus applied thereto; Fig. 2 represents a front elevation of the mechanism by which the furnace drafts are controlled; and Fig. 3 is a sectional detail of such mechanism.

In carrying out my invention, I make use of the variations in pressure of the steam in the boiler to displace a liquid from a receptacle, the liquid serving to operate suitable dampers to check the furnace drafts, and a counterpoise serving to operate the furnace drafts in the reverse direction when the pressure falls.

Describing the parts by reference characters 1 denotes a steam boiler furnace having a damper 2 through which air may be admitted to the ash pit to promote combustion in the furnace proper. This damper is shown as a door which is pivoted to the front of the ash-pit.

3 denotes the flue leading from the combustion chamber and provided with a check-draft damper 4. Above and surrounding the combustion chamber is located the boiler proper, said boiler having therein a maintained water level, denoted by the broken line 5—5. At a suitable distance from the boiler there is provided a receptacle 6 supported on a suitable standard 7. This receptacle is provided with a filling opening having a closure 8.

9 denotes a pipe leading from the upper portion of the receptacle 6 to the lower portion of the boiler. The point at which pipe 9 communicates with the receptacle 6 will constitute an overflow for the liquid in the receptacle and will serve, under normal conditions, to maintain a level of liquid in said receptacle. As will appear by reference to Fig. 1, the upper end of receptacle 6 is considerably above the water level in the boiler and the level of the liquid in the receptacle 6 is normally above the level of the liquid in the boiler. The pipe 9 is provided with a check valve 10, opening toward the boiler, whereby the flow of water from the boiler to the receptacle is prevented.

11 denotes a pipe extending from the top of the receptacle 6 to the steam space of the boiler, being shown as connected to the dome 12. From this dome any suitable number of pipes 13 may extend to points of use as, for instance, to radiators for heating purposes.

A bracket 14 projects from the receptacle 6 and is preferably cast therewith. This bracket forms a support for the lower end of a rod 15 which carries at its upper end the yoke 16 having bearings 17 in the arms thereof. The bearings form a journal for a pipe section 18. This section carries a cross fitting 19 which is connected at one end with a pipe 20 extending to a receptacle 21. The other end of said fitting is connected with a lever arm 22 having an adjustable weight 23 thereon. The pipe 20 and the arm 22 constitute opposite arms of a lever which is pivoted in the bearings 17. The yoke 16 is provided with extensions 24 arranged at right angles with respect to the yoke arms which have the bearings 17, and each extension 24 is provided with an adjustable stop 25, $25^a$, which are adapted to engage the opposite arms of the pivoted lever and limit the downward movements thereof. The lower end of the rod 15 is threaded and is provided with a pair of nuts $15^a$ by means of which the yoke 16 may be vertically adjusted, thereby enabling the point of support of the lever to be varied with respect to the level of liquid in the tank 6. As the arm 20 and receptacle 21 are supplied from the receptacle 6 by the pressure of the steam in the boiler transmitted through pipe 11, it will be seen that this adjustment of the yoke affords a convenient means for varying the boiler pressure at which the dampers will be operated.

T. G. MOUAT.

PRESSURE REGULATING APPARATUS.

APPLICATION FILED APR. 30, 1909.

**937,686.**

**Patented Oct. 19, 1909.**

2 SHEETS—SHEET 2.

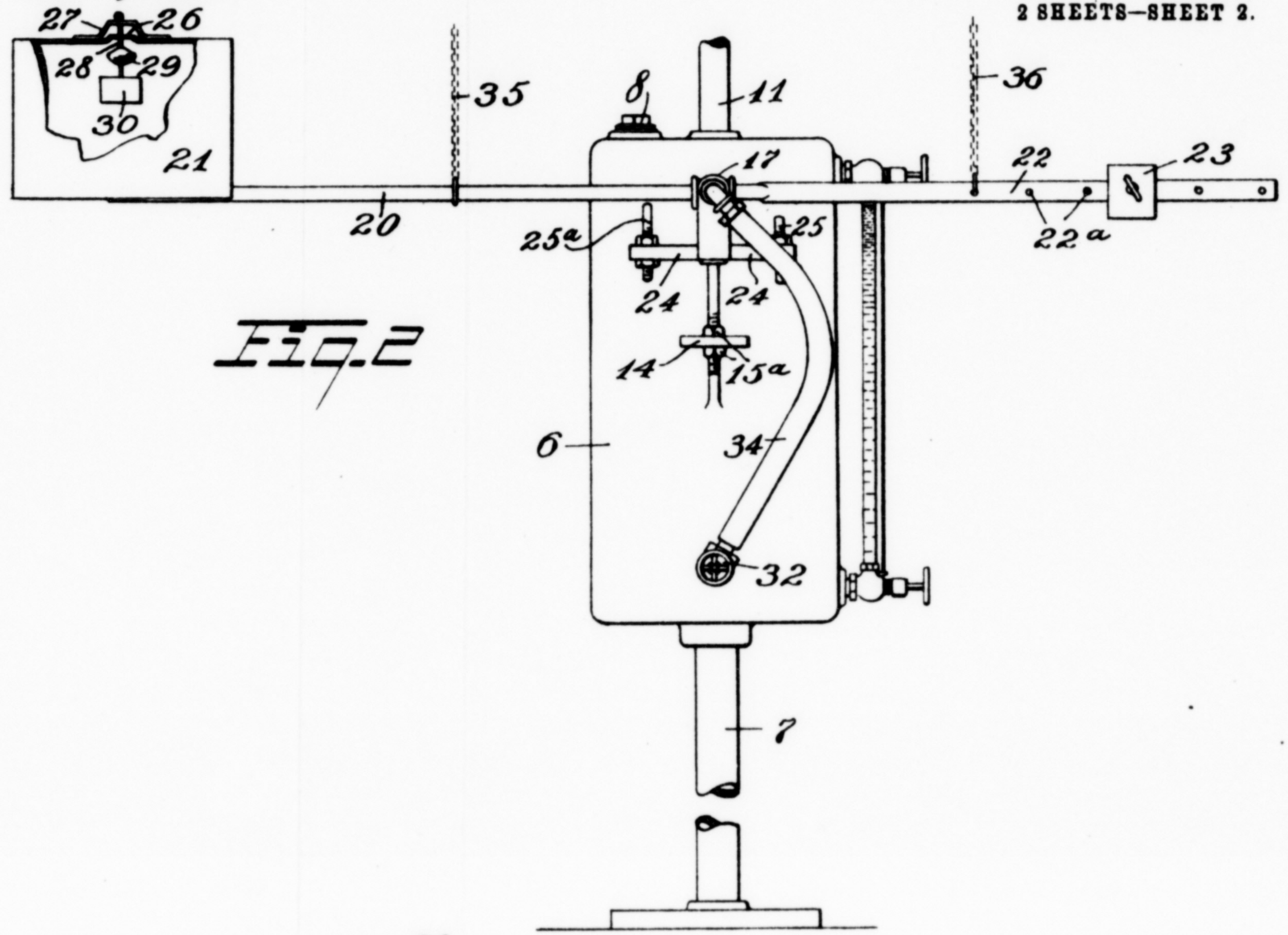

Fig. 2

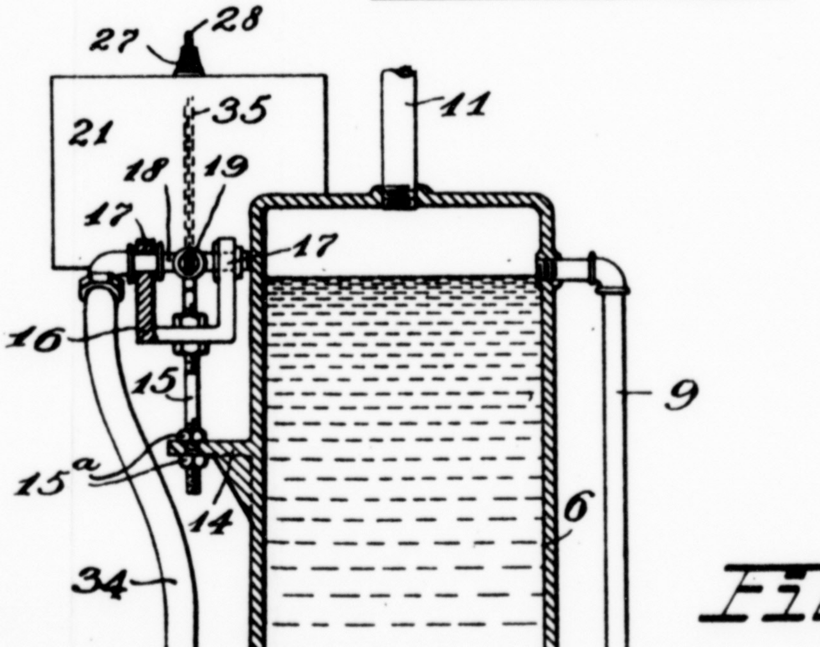

Fig. 3

Witnesses:-
Nathan F. Fretter
Brennan B. West.

Inventor.
Thomas G. Mouat
By Bates, Fouts & Hull.
Attys

12

T. G. MOUAT.

PRESSURE REGULATING APPARATUS.

APPLICATION FILED APR. 30, 1909.

**937,686.** Patented Oct. 19, 1909.

2 SHEETS—SHEET 1.

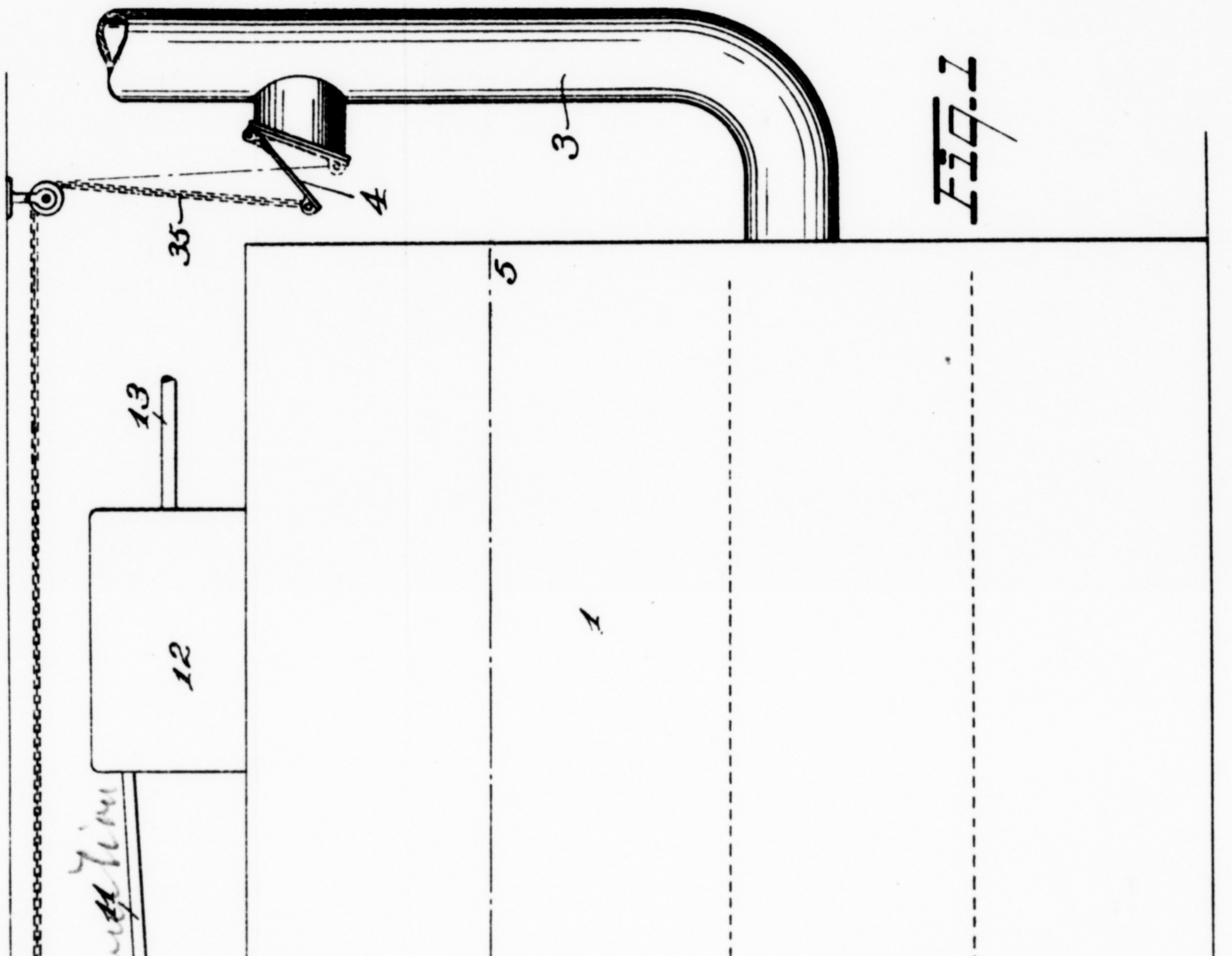

Fig. 1

Witnesses:

N. F. Fritter

Brennan B. West.

Inventor.

Thomas G. Mouat

By Bates, Fouts & Hull.

Attys

## EXHIBIT B.

# DIRECTIONS FOR CONNECTING THE HUTCHISON DAMPER REGULATOR AND TRAP RECEIVER No. 1¼

Hutchison Vapor Heating Cap. etal v. Thomas G. Monat } No. 3156
pages 17 & 18

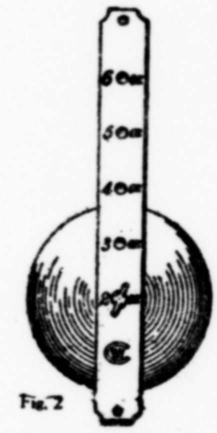

Fig. 2

To change the pressure remove the thumb screw from the reservoir and connect reservoir to indicator plate at hole opposite the number of ounces desired to be carried.

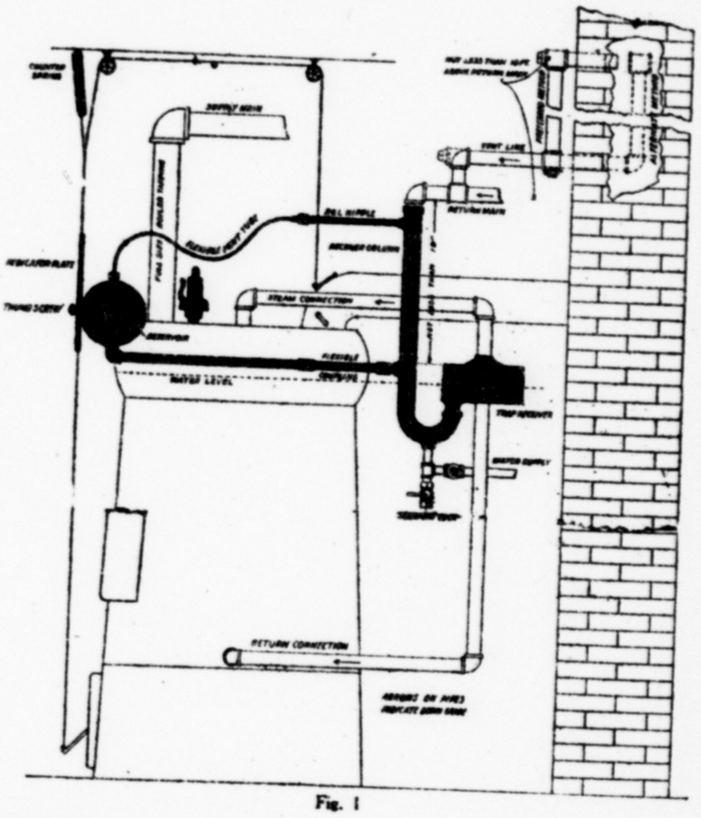

Fig. 1

The complete equipment of the HUTCHISON TRAP RECEIVER AND DAMPER REGULATOR is shown in the bold shaded lines of Fig. 1.

Locate TRAP RECEIVER at any convenient point on same side of boiler as front draught eye. The distance from the Damper chain to center of RECEIVER COLUMN is 31 inches. Place center of TRAP RECEIVER on level with or above highest working water line in the boiler, but never lower. Make top and bottom connections to boiler, grading horizontal pipe in both instances toward boiler. Connect top of RECEIVER COLUMN with return main, using proper length nipple to make connection. Screw the pulleys in ceiling, as shown, so that damper chain will fall directly to front draught eye and to check draught eye. Place screw eye in ceiling, as shown, so that chain between pulleys will work smoothly through same. Cut piece of chain long enough to reach from point 4 inches above bottom of TRAP RECEIVER to front draught eye, when draught is normally open and connect to same. Connect other end of chain to bottom of INDICATOR PLATE. ~~When front draught is normally open and check draught~~ is closed the bottom of indicator plate must be 4 inches above bottom of TRAP RECEIVER. Connect another piece of chain to the top of INDICATOR PLATE and pass over pulley—through screw eye and over pulley—connecting to the check damper. Place ring through chain to rear of screw eye, as shown, so that when front draught is closed and check damper is open to its full capacity the ring will stop the downward movement of the RESERVOIR. Connect SHORT FLEXIBLE COUPLING, as shown, and to this connect pipe and RESERVOIR, using great care not to twist the FLEXIBLE COUPLING. Connect RESERVOIR to INDICATOR PLATE, as shown, in figure 2, at the number of ounces desired to be carried in the system. Connect small FLEXIBLE TUBING to top of RESERVOIR, completing connection with RIGHT and LEFT LONG NIPPLE to half-inch tapping near top of RECEIVER COLUMN. Place screw hook in ceiling, as shown, and connect spring to same. Connect lower end of spring with chain so that it will have only sufficient tension to hold the front damper open and check damper closed when RESERVOIR is empty. Connect feed water supply to 1" tapping in bottom of RECEIVER COLUMN, using Tee for this connection, and place SEDIMENT COCK at the base of Tee to drain TRAP RECEIVER when necessary. Lowering the water line of boiler will not interfere with the operation of the DAMPER REGULATOR.

KEEP THE ASH PIT DOOR SHUT.

Attention is called to the VENT LINE to the flue. In figure 1 we show two methods, the solid lines representing the method with vent line following flue on outside to not less than 10 feet above return main and there entering the flue. Note that Tees are placed at all angles, the back outlet of Tees being plugged for clean out. Where it is objectionable to run the vent line on the outside of the flue same may be run in the flue, as shown by the alternate method indicated by the dotted lines, and placing a bull head Tee on the top of vent line. The vent line should always be of galvanized pipe.

The HUTCHISON VAPOR VALVES are made in three sizes, ½" valves for radiators of 30 sq. ft. or less, ¾" valves for radiators of 31 to 90 sq. ft., 1" valves for radiators of 91 to 180 sq. ft.

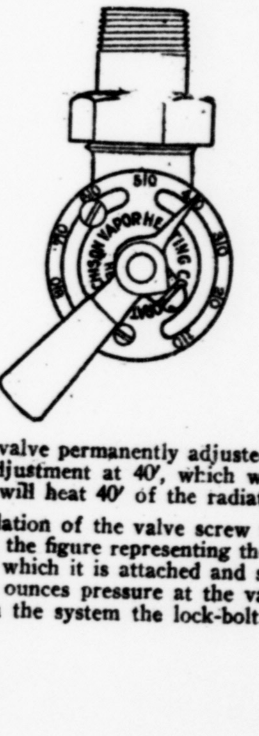

Fig. 3

Figure 3 represents valve permanently adjusted for a 60' radiator with the temporary adjustment at 40', which with the pressure of 2 ounces at the valve will heat 40' of the radiator.

For permanent regulation of the valve screw the lock-bolt in the slot in the dial plate at the figure representing the number of square feet in the radiator to which it is attached and securely lock. This adjustment is for two ounces pressure at the valve. Should other pressures be carried in the system the lock-bolt should be proportionately adjusted.

(Over.)

**POST THIS SIDE IN FURNACE ROOM**

# DIRECTIONS FOR OPERATING THE HUTCHISON SYSTEM OF VAPOR HEATING

The water in the boiler should show about half way of the gauge glass. The dampers and regulator should work freely, and when at rest the front draught normally open and the check draught closed.

Start fire and adjust smoke pipe damper at the proper position to secure best results in combustion.

When pressure reaches the number of ounces at which thumb screw on indicator plate is set the DAMPER REGULATOR will begin to operate, closing front draught and checking fire. When pressure begins to fall front draught will open and check draught close.

Use fuel recommended, and fire boiler as directed by the boiler manufacturer.

Should the water disappear from the glass in the boiler through leaks or evaporation while there is yet fire in the boiler, never add water to the boiler without first drawing fire.

The heating contractor will test the plant and leave VALVES and DAMPER REGULATOR adjusted in their proper positions. DO NOT DISTURB ANY ADJUSTMENT MADE BY THE HEATING CONTRACTOR unless, due to high winds or extremely low temperature, sufficient heat is not obtained when the valves are open to the extreme permanent adjustment. In such case the thumb screw on the indicator plate at the boiler may be raised to the next hole above, when sufficient heat will be obtained. DO NOT NEGLECT TO RESTORE THUMB SCREW TO FORMER POSITION WHEN WEATHER MODERATES.

In all rooms in which heat is not desired the radiator valves may be closed without danger of freezing and thus save fuel. When a lesser amount of heat is desired the radiator valves may be turned back or entirely closed, and the DAMPER REGULATOR will automatically control the fire until such time as heat is desired.

Should the radiator valves at any time become difficult to turn, a slight pressure or jar on the valve stem, where the handle connects, will relieve this condition.

PULL LEVER ON POP VALVE ONCE A DAY TO SEE IF IT IS IN WORKING CONDITION.

OPEN COCK UNDER BEND ABOUT ONCE A MONTH AND DRAW ABOUT ONE PINT OF WATER, REMOVING SEDIMENT.

SHOULD THE PLANT BE LEFT IN FREEZING WEATHER WITHOUT FIRING, WATER SHOULD BE DRAINED FROM BOILER AND TRAP-RECEIVER.

This heating system is adjusted to run at

.............. ounces, boiler pressure.

Signed........................................................

*Heating Contractor.*

**KEEP THE ASH PIT DOOR SHUT**

**Hutchison Vapor Heating Corporation, Woodward Building, Washington, D. C.**

to a sum equal to three times the amount of such assessment under the circumstances of the unlawful and unjust and aggravated nature of the infringement.

D. That a writ of injunction may be issued from and under the seal of this Court perpetually and provisionally enjoining and restraining the said defendants, Hutchison Vapor Heating Corporation and George H. Zellers, their officers, agents, clerks, servants, attorneys and workmen from any further manufacture and sale
10 or use in any manner of the said patented improvements or
any part thereof, and from manufacturing, using, selling, offering for sale or giving away Pressure Regulating Apparatus containing the inventions or improvements described and claimed in said Letters Patent No. 937,686, and particularly in claims 7 and 10 thereof.

E. That a writ of subpœna may issue directed to the said defendant Hutchison Vapor Heating Corporation, and to the said defendant George H. Zellers, commanding them and each of them on a day certain therein to be named and under a certain penalty therein limited to be and appear in this Honorable Court then and there to answer the premises and to abide by and perform such order and decree as may be made against them.

F. That your orator may have such other and further relief in the premises as may be agreeable to equity and good conscience and as to your Honors may seem meet.

And your orator will ever pray, etc.

THOMAS G. MOUAT.

HULL, SMITH, BROCK & WEST,
HAROLD E. SMITH,
*Attorneys for Plaintiff.*

STATE OF OHIO,
*County of Cuyahoga, ss:*

Before me personally appeared the above named Thomas G. Mouat to me known, who being duly sworn on oath deposed and said that he is the plaintiff named in the foregoing Bill of Complaint, that he has read the said Bill of Complaint and knows the contents thereof and that the same is true to his own knowledge except as to
the matters therein stated on information and belief and as
11 to those matters he believes it to be true.

THOMAS G. MOUAT.

Sworn to and subscribed before me this 6th day of December, 1915.

HUGH B. McGILL,
*Notary Public.*

[SEAL.]

I have read the foregoing Bill of Complaint and under the instructions given me I think it well grounded and non-scandalous.

HAROLD E. SMITH,
*Solicitor of Record.*

(Here follow drawings and specifications marked pages 12-18, incl.)

19 EXHIBIT C.

C. L. Sturtevant. E. G. Mason.

Sturtevant & Mason,

Attorneys & Counselors in Patent & Trade Mark Causes,

Washington Loan & Trust Building,

Washington, D. C.

S. B.

September 18th, 1915.

Mr. H. E Smith, Messrs. Hull, Smith, Brock & West, Illuminating Building, Cleveland, O.

DEAR SIR: Referring further to the matter under discussion between your clients, the owners of the Mouat patent No. 937,686, and our clients the Hutchison Vapor Heating Company, we have to advise you that while our clients feel they have (under our advice) a perfectly good case of non-infringement and one which could be still further strengthened by slight changes, nevertheless they are disposed if possible to avoid the expense and annoyance of litigation.

The sum mentioned by you in your last interview with us, viz., $2,500 lump sum for a license which might be exclusive as to certain territory, is rather considerable for a new concern to pay out at one time, and they would prefer to split it up into annual payments during the life of the patent. $2,500 at one time seems a good deal more than $3,000 divided up into eight or ten annual payments. Do you think your clients would consider a proposition of $300 a year royalty for the rest of the life of the patent, beginning with say the first of July, 1915? As you know, our clients want to fight, yet they don't want to fight; they are willing to settle by payment of a reasonable sum, but don't want to pay it all at once.

20 If you think a proposition as above outlined would be favorably considered by your clients, let us know and we will have it put into formal shape.

Very truly yours,

STURTEVANT & MASON.

*Defendants' Answer to Bill.*

Filed January 22, 1916.

* * * * * * *

Hutchison Vapor Heating Corporation and George H. Zellers, trading as Zellers & Company, for joint and several answer to the Bill of Complaint of Thomas G. Mouat, allege:

1. Defendant Hutchison Vapor Heating Corporation admits that it is a corporation of Virginia, having an office and place of business at Washington, in the District of Columbia, and Defendant George H. Zellers admits that he is a resident and inhabitant of the City of Washington in the District of Columbia, where he has a regular and established place of business conducted under the name of Zellers & Company.

2. Defendants admit the jurisdiction of this Court as depending upon the Patent Laws of the United States.

3. Defendants admit that on October 19th, 1909, Letters Patent of the United States No. 937,686, were granted to Thomas G. Mouat, but denies that the said Letters Patent are valid, and denies that the said Mouat duly complied in all respects with the then existing statutes of the United States and Rules of Practice of the United States Patent Office, and, therefore, denies the allegations of paragraph 1 of the Bill of Complaint.

21 4. Defendants are without information sufficient to form a belief as to the matters alleged in paragraphs 3 and 6 of the Bill of Complaint, and call upon the Plaintiff to make strict proof thereof.

5. Defendants deny that any acts of theirs have interfered with any rights or privileges belonging to the Plaintiff, and, therefore, deny the matters alleged in paragraph 4 of the Bill of Complaint.

6. Defendants deny that said Plaintiff was the original, first and sole inventor and discoverer of the inventions and improvements described in the aforesaid Letters Patent and particularly in claims 7 and 10 thereof, and deny that he is entitled to be protected in the exclusive enjoyment thereof, as is set forth in paragraph 5 of the Bill of Complaint.

7. Defendants deny that they have ever made or threatened to make, or used or caused to be used, or sold or caused to be sold at any time without the consent of the Plaintiff, in the District of Columbia or elsewhere, Pressure Regulating Apparatus for Heating Systems, made in accordance with and embodying the alleged invention set forth in claims 7 and 10 of the aforesaid Letters Patent, and deny that they have in any manner infringed said patent.

8. Defendant Hutchison Vapor Heating Corporation admits that in the Spring of 1915 it received a notice from parties representing themselves to be attorneys for Thomas G. Mouat, calling attention to alleged infringing acts on the part of Defendant, but denies that since that time repeated warnings against continuing said acts have been received by it; said defendant denies the allegations of paragraph 8 of the Bill of Complaint in the manner set forth with
22 respect to the negotiations for license, but on the contrary alleges that a long series of negotiations by correspondence and interviews took place between the attorneys for the Plaintiff and Defendants with a view of avoiding to both parties the annoyance and expense of litigation; that at no time did Defendants admit the validity or acknowledge infringement of the aforesaid patent, but will affirmatively show that all suggestions of settlement emanating from them were solely with a view to saving expense of litigation; said Defendant Hutchison Vapor Heating Corporation further al-

leges that the suggestions as to licence set forth specifically in paragraph 8 of the Bill of Complaint was a counter-proposition to a suggestion for settlement made by Plaintiff's attorneys and was the culmination of a series of negotiations in which at no time had Defendants acquiesced in the validity of, and infringement by it of the aforesaid patent 937,686, but had always expressly stated that any suggestion of payment by it to Plaintiff was to save expense of litigation.

The Defendant George H. Zellers has no knowledge or information sufficient to form a belief as to the matters alleged in paragraph 8 of the Bill of Complaint.

9. Defendants have no knowledge or information sufficient to form a belief as to the matters alleged in paragraphs 9 and 10 of the Bill of Complaint, and call upon the Plaintiff to make strict proof thereof.

10. Defendants deny the allegations of paragraph 11 of the Bill of Complaint.

11. Defendants deny the allegations of paragraph 12 of the Bill of
Complaint in so far as they carry with them the charge of
23 infringement of Plaintiff's rights, but on the contrary they
aver that by their own special inventions and improvements
and facilities of manufacturing and marketing, they have been enabled to furnish to the consumer a cheaper and better product than is furnished by the Plaintiff, and that nothing they have done has been in violation of any of the rights of the Plaintiff.

12. The Defendants, upon information and belief, deny that said Letters Patent are valid, and affirmatively allege that they are void and of no force and effect, for the following reasons:

*a.* Prior to said alleged invention by said Mouat the alleged improvement or substantial and material parts thereof described and claimed in said Letters Patent, was shown and described in the following Letters Patent:

*United States Letters-Patent.*

| Name. | Number. | Date. |
|---|---|---|
| M. Nutting | 16,604 | Feb. 10, 1857 |
| E. & J. Bourne | 37,382 | Jan. 13, 1863 |
| J. M. Osgood | 44,884 | Nov. 1, 1864 |
| H. L. McAvoy | 93,104 | July 27, 1869 |
| W. B. Hayden | 119,270 | Sept. 26, 1871 |
| J. K. Meschter | 320,490 | June 23, 1885 |
| H. B. Tatham, Jr. | 333,790 | Jan. 5, 1886 |
| E. N. Gates | 401,940 | Apr. 23, 1889 |
| E. N. Gates | 402,076 | Apr. 23, 1889 |
| A. M. Butz | 441,745 | Dec. 2, 1890 |
| B. A. Hawkins | 462,005 | Oct. 27, 1891 |
| A. Catchpole | 496,040 | Apr. 25, 1893 |
| J. K. Meschter | 526,404 | Sept. 25, 1894 |
| T. O. Perry | 528,799 | Nov. 6, 1894 |
| T. O. Perry | 528,800 | Nov. 6, 1894 |
| T. O. Perry | 528,801 | Nov. 8, 1894 |
| J. J. Roy | 632,371 | Sept. 5, 1899 |

| | | |
|---|---|---|
| A. P. Broomell | 650,778 | May 29, 1900 |
| H. A. R. Dietrich | 704,623 | July 15, 1902 |
| W. E. Roys | 705,969 | July 29, 1902 |
| A. P. Broomell | 717,335 | Dec. 30, 1902 |
| J. N. Stephens | 727,018 | May 5, 1903 |
| W. Shurtleff | 781,467 | Jan. 31, 1905 |
| W. L. Hager | 870,028 | Nov. 5, 1907 |
| C. T. Ammon | 904,499 | Nov. 24, 1908 |
| J. L. Welshans | 905,037 | Nov. 24, 1908 |
| N. M. Eddy | 917,566 | Apr. 6, 1909 |

24 *French Patent.*

| | | |
|---|---|---|
| Sorel | 3,844 | Oct. 7, 1833 |

*German Patent.*

203,764.

*Danish Patent.*

10,994.

(*b*) The alleged invention described and claimed in the Mouat patent does not, in view of the state of the art as it existed prior to the date of said alleged invention, exhibit any patentable novelty, but consists merely in the adaptation and use of well known forms of pressure regulating devices for heating systems.

(13) The defendants allege that in view of the prior state of the art existing at the time of the alleged invention of said Mouat, and in view of the actions and proceedings by said Mouat to obtain said Letters-Patent, the said Letters-Patent and the claims thereof, particularly claims 7 and 10, cannot be construed to cover any pressure regulating apparatus for heating systems which defendants have made, used or sold, or caused to be made, used or sold.

(14) The defendants deny the equity of plaintiff's bill of complaint, and allege that the plaintiff is not entitled to an injunction, to damages or to account of profits, or to any relief or recovery whatsoever against these defendants as prayed in said bill of complaint.

25 Wherefore, the defendants pray the bill of complaint herein be dismissed, defendants to recover their costs and disbursements in this suit.

HUTCHISON VAPOR HEATING
CORPORATION,
HAROLD B. CHASE, *President.*
ZELLERS & CO.

CHARLES L. STURTEVANT,
*Solicitor for Defendants.*

Jan. 22, 1916.

*Decree Reviving Suit, &c.*

Filed April 6, 1917.

* * * * * * *

It is hereby ordered that George H. Zellers, Junior, executor of the estate of George H. Zellers, (trading as Zellers & Company), be substituted as one of the parties defendant in the above entitled cause; that all subsequent proceedings stand revived including the service of the subpœna therein and that this cause shall be entitled Thomas G. Mouat, plaintiff, vs. Hutchison Vapor Heating Corporation and George H. Zellers, Junior, executor of the estate of George H. Zellers (trading as Zellers & Co.), defendants, in equity No. 33962.

April 6/17.

WALTER I. McCOY,
*Judge.*

I consent to the entry of this order.

CHARLES L. STURTEVANT.

I also enter my appearance as counsel for Geo. H. Zellers Jr.

CHARLES L. STURTEVANT.

26 *Decree Fixing Title to Patent, &c.*

Filed October 17, 1917.

* * * * * * *

This cause having come on at this term of Court was tried at final hearing and argued by counsel; and therefore, upon consideration thereof, it is Ordered, Adjudged and Decreed:—

First. That the letters patent in suit No. 937,686, granted October 19th, 1909, to Thomas G. Mouat for new and useful improvements in Pressure Regulating Apparatus are good and valid in law as respects the invention therein described and particularly set forth in claims numbered 7 and 10.

Second. That the title hereto and to the invention described and claimed therein is vested in the Plaintiff, Thomas G. Mouat.

Third. That Defendants, Hutchison Vapor Heating Corporation and George A. Zellers, Jr., and each of them has infringed claims 7 and 10 of such patent and the exclusive rights of the Plaintiff thereunder by making or having made, selling and installing or having installed systems, embodying:

A. The combination, with a boiler and means for heating the same, of means for maintaining substantially constant the pressure of steam generated thereby, said means comprising a receptacle, a pipe connecting said receptacle with the water space in the boiler and extending above the bottom of said receptacle, a pipe connecting the upper portion of said receptacle with the steam space of the

boiler and arranged to drain towards said receptacle a movably sup-
ported receptacle communicating with the former receptacle,
27 and connections between said receptacle and the means for
heating said boiler.

B. The combination, with a boiler and means for heating the same, of means for maintaining substantially constant the pressure of steam generated by said boiler, said means comprising a receptacle extending above the water line of the boiler, a pipe connecting said receptacle with the boiler and extending above the bottom of said receptacle, a pipe connecting said receptacle with the steam space of the boiler and arranged to drain toward said receptable, a movably supported receptacle communicating with the former receptacle and arranged to drain into the former receptacle, and connections between the latter receptacle and the means for heating the boiler.

Fourth. That Plaintiff do recover of the defendants, Hutchison Vapor Heating Corporation and George H. Zellers, Jr., or either of them, the gains, profits, savings, and advantages which defendants have derived, received, or made by reason of their infringement of the said claims of said Letters Patent, and that the Plaintiffs do recover of the defendant, Hutchison Vapor Heating Corporation and George H. Zellers, Jr., or either of them, the damages which the plaintiff has sustained by reason of such infringement; that this cause be referred to, Albert Harper Esq., Examiner in Chancery, who on account of his special qualifications and fitness therefor, is hereby appointed Master and Chancellor of this Court, to ascertain the amount of such gains, profits, savings, and advantages, to ascertain such damages, to report thereon with all convenient speed;
and the defendants and each of them, their officers, attorneys,
28 clerks, agents, servants, and workmen are hereby directed and
required to attend the aforesaid Master upon summons from
him from time to time as required, and to produce and submit to him such books, papers, vouchers or documents, and to submit to such oral examination as the Master may require.

Fifth. That a perpetual injunction be issued out of and under the seal of this Court directed to each of the said defendants, the Hutchison Vapor Heating Corporation and George H. Zellers, Jr., their agents, attorneys, clerks, servants, workmen and employes, enjoining and restraining them, and each of them, from directly or indirectly making or causing to be made, selling or causing to be sold, using or causing to be used, or vending to others to be used, any articles, devices, or appliances for Vapor Heating Systems, containing, embodying, or employing the said invention and improvements granted by said Letters Patent and particularly the 7th and 10th claims thereof; or from infringing upon or violating the said Letters Patent in any manner whatsoever.

Sixth. That Plaintiff do recover of defendants his costs and disbursements of this suit to be taxed, including the cost of the Transcript of Record.

WILLIAM HITZ, *J.*

Oct. 17, 1917.

29 *Petition on Appeal.*

Filed October 17, 1917.

* * * * * * *

Hutchison Vapor Heating Corporation and George H. Zellers, Jr., defendants in the above entitled cause, considering themselves aggrieved by the decree entered on the 17″ October, 1917, in said cause, do hereby appeal from said decree and decision of this Court in the above entitled cause to the Circuit Court of Appeals of the District of Columbia, for the reasons specified in the Assignment of Errors which is filed herewith; and it prays that this appeal may be allowed and that citation issue as provided by law, and that a Transcript of the Record proceedings and papers upon which said decree was made, duly authenticated, and all exhibits, as set forth in the Præcipe, may be forwarded to the Circuit Court of Appeals of the District of Columbia; that the issues in said decree relative to an injunction, accounting and costs be suspended pending said appeal; and to that end your petitioners pray that with the allowance of this appeal a stay of proceedings in said cause in this Court, pending said appeal, be issued and a supersedeas be issued; and your petitioners herewith tender bond in such amount as the Court may require as security for the costs of the Plaintiff on said appeal and for said supersedeas.

Dated this 17th day of October, 1917.

CHARLES L. STURTEVANT,
EUGENE G. MASON,
*Solicitors for Defendant.*

The above petition is granted and appeal prayed in open court is allowed and the same shall operate as a supersedeas and stay
30 of the injunction and all proceedings in this Court pending said appeal upon the Defendant's filing a proper bond therefor as required by law in the sum of $5,000 five thousand dollars.

WILLIAM HITZ,
*Judge.*

*Assignment of Errors.*

Filed October 17, 1917.

* * * * * * *

And now to wit, on the 17″, October, 1917, come the Defendants, Hutchison Vapor Heating Corporation and George H. Zellers, Jr., by Charles L. Sturtevant and Eugene G. Mason, their Solicitors and counsel, and say that the decree entered in said cause on the 17″ day of October, 1917, is erroneous and against the just rights of said defendant as follows:

1. The Court erred in holding the patent in suit and particularly claims 7 and 10 thereof valid over the prior art.

2. The Court erred in holding that the patent in suit and particularly claims 7 and 10 thereof were infringed by the defendant.

3. The Court erred in entering a decree against the Defendants.

4. The Court erred in not dismissing the Bill of Complaint for want of equity.

Wherefore the said Defendants pray that the said decree be reversed and that the said Court may be directed to enter a decree dismissing the Bill of Complaint.

CHARLES L. STURTEVANT,
EUGENE G. MASON,
*Solicitors for Defendant.*

31 *Stipulation.*

Filed October 17, 1917.

* * * * * * *

It is hereby stipulated and agreed by and between the parties hereto that the Transcript on appeal in the above cases shall consist of the matters specified in the Præcipe hereto attached.

CHARLES L. STURTEVANT.

CHAS. E. BROCK,
*Plaintiff's Solicitor.*

*Designation of Record.*

Filed October 17, 1917.

* * * * * * *

To the Clerk of Said Court.

Sir: Please prepare Transcript on appeal, consisting of the following:

1. Bill of Complaint.
2. The Answer.
3. The accompanying prima facie deposition on behalf of the Plaintiff presented in narrative form.
4. The accompanying deposition on behalf of Defendants in narrative form.
5. The rebuttal deposition on behalf of Plaintiff.
6. The Court's opinion.
7. The decree.
8. The Assignment of Errors.
9. Petition and allowance of Appeal.
10. All exhibits of both parties to the suit and such other matter of record that might have been overlooked and may be desired by either party. 32

CHARLES L. STURTEVANT,
EUGENE G. MASON.

Service on the above Præcipe acknowledged this 17th day of October, 1917.

CHAS. E. BROCK,
*Solicitors for Plaintiff.*

*Decree Modifying Order of October* 17, 1917.

Filed November 5, 1917.

* * * * * * *

On motion of Counsel for Defendants, the order of October 17, 1917, granting the petition on appeal and allowing a stay of proceedings upon the filing of a supersedeas bond is hereby modified upon the statement by Defendant's Counsel that the supersedeas bond cannot be furnished. It is therefore ordered that the injunction shall issue and that the stay of proceedings be withdrawn but that the petition for appeal be allowed upon the deposit by Defendants of One hundred Dollars in cash, as security for costs on appeal.

WILLIAM HITZ,
*Judge.*

Nov. 5th, 1917.

*Memoranda.*

November 5, 1917. $100 deposited in lieu of Appeal Bond.

November 30, 1917. Statement of Evidence submitted to the Court.

December 27, 1917: Statement of Evidence signed and made of record.

33 Supreme Court of the District of Columbia.

UNITED STATES OF AMERICA,
*District of Columbia, ss:*

I, John R. Young, Clerk of the Supreme Court of the District of Columbia, hereby certify the foregoing pages numbered from 1 to 32, both inclusive, to be a true and correct transcript of the record, according to directions of counsel herein filed, copy of which is made part of this transcript, in cause No. 33,962, in Equity, wherein Thomas G. Mouat is Plaintiff and Hutchison Vapor Heating Corporation, et al. are Defendants, as the same remains upon the files and of record in said court.

In testimony whereof, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 11th day of February, 1918.

[Seal Supreme Court of the District of Columbia.]

J. R. YOUNG,
*Clerk.*
By ALF. G. BUHRMAN,
*Ass't Clerk.*

34 *Record.*

## In Narrative Form.

Copy of letters patent number 937,686, granted October 19, 1909 to Thomas G. Mouat, was offered in evidence and marked "plaintiff's exhibit number 1".

A stipulation was presented and marked as "plaintiff's exhibit number 2", setting forth the title to the patent in the plaintiff; that the defendants, Hutchison Vapor Heating Corporation, had sold in the District of Columbia and defendants, Zellars and Company, had installed within the District of Columbia prior to the filing of the Bill of Complaint and within six years thereof the Hutchison Vapor Heating System at certain residences in Washington and at the National Savings and Trust Company Bank Building; that the residential installations were in general, similar to the illustrations shown in the Hutchison Vapor Heating Corporation catalogue, which was attached to interrogatives filed by plaintiff before the trial, which catalogue was marked "Exhibit D" and is a part of the record; that the photographs of the National Savings and Trust Company installation, are correct representations thereof; that printed copies of patents offered in evidence may be accepted with the same force and effect as those certified; and finally that plaintiff charged infringement of claims seven and ten only, of the patent in suit and does not charge infringement of any of the other claims.

35 F. L. O. Wadsworth, on behalf of plaintiff deposes that he is forty-nine years(49) old, a resident of Pittsburg-, Pennsylvania and by occupation, consulting engineer; that he has examined and understands the patent in suit and that he has examined plaintiff's circular illustrating the Mouat heating system and has examined Mouat installations. Witness produced a Mouat circular and the same was marked "plaintiff's exhibit number 3" and witness testified that the circular showed and described a construction such as shown and described in the patent in suit.

In his description of the plaintiff's construction, witness made use of a diagram which he had prepared and which he stated illustrated in all sense and particulars the characteristic features of construction illustrated and described in the Mouat patent in suit. This illustrated diagram was afterward offered in evidence and marked "plaintiff's exhibit number 7". The witness then proceeded with his prima facie deposition as follows:

"This diagram is the one to which plaintiff's counsel referred in his opening statement. The Mouat invention is particular- adapted to regulate the pressure of steam in what is known as a vapor heating system. The Court is no doubt aware of the fact that there are two very well known systems of heating in use in ordinary dwellings; one is known as the hot water system, and the other one is known as the steam system of heating.

In the hot water system of heating the hot water is carried from the hot water boiler to the radiators in different parts of the house and at those radiators it parts with a certain amount of heat and then returns to the boiler. In this system there is no evaporation of the water. In the steam heating system the water
36
in the boiler is first converted into steam, and that steam is then conveyed through a proper system of piping to the various radiators of the building. When it enters the radiators it condenses and in condensing it gives up what is known as the latent heat of evaporation, the latent heat being the heat which is necessary to convert the water in the liquid form to the water in the vapor form or steam.

After such condensation the water returns from the radiators either through the same pipe that was used to convey steam thereto, or preferably, through a separate return system of pipes, and again enters the boiler.

In ordinary steam heating systems the pressure that is carried in the system has in the past varied from five to ten pounds up to sometimes as high as 20 or 25 pounds. Ordinarily stated, that system may be termed a high-pressure system, as contrasted with the system that we are concerned with in this case.

A few years ago, some six or seven years according to my best recollection, another system of steam heating began to come into use, which is known as the vapor heating system. In that system the water is evaporated and conveyed in the form of steam to the radiators, but instead of being conveyed at a pressure of from five to twenty-five pounds it is carried through the system at a pressure of only two to four ounces, something about one-twentieth to one-one-hundredth part of the pressure employed in the ordinary old form of high-pressure heating apparatus.

Now, the introduction of this low-pressure steam heating system called for a different system of regulation than had been in use before that. In hot water systems the temperature of the water that is carried to the radiators can be very well regu-
37
lated by what is known as a thermostatic device, that is a device which expands and contracts as the temperature of the water rises and falls, and by such expansion and contraction effects a regulation of the fuel supply, either by the turning of a cock which controls the gas flow to burners or by the opening and closing of dampers in the fire-box and in the stack flue respectively, where solid fuel is burned.

In the high-pressure steam system the control of the fuel supply can correspondingly be effected very well by the use of an oridnary pressure regulator such as an ordinary diaphragm valve construction, in which a movable part of the diaphragm is raised or lowered as the pressure of the steam rises and falls. That system of regulation is fairly effective in the case of high-pressure steam systems, because the variations in pressure with which we can there deal are very marked. For example, if we are carrying a pressure normally of only five pounds on the system we can afford to have a variation of 20 per cent on that pressure, or, say, one pound either above

or below the normal, and a variation of one pound pressure in steam when it acts upon a diaphragm can exert a sufficient force upon that movable diaphragm to move the necessary parts that control the fuel regulation, such as a valve or a damper. But when we come to these low pressures we have to deal with very much more minute variations in the pressure of the fluid, and in consequence of that we have very much less force, that is, a very much smaller force that is available for the control of the movable parts of the fuel control apparatus. Normally, in these vapor-heating systems the pressure
varies from about two ounces to possibly seven or eight
38 ounces, and the variations that we can allow in the system
are correspondingly small. With a normal pressure of two ounces, for example, we have, even with a variation of fifty per cent above or below the normal, a force corresponding to only one ounce pressure to move any regulating device that it was desired to use for the control of the fuel supply.

That necessity of operating the regulating device for comparatively small variations in pressure introduced, as I say, new problems into the art, and it is the purpose of this Mouat regulator, as described in the patent in suit, to afford a solution, one solution at least, of that problem.

The general construction and arrangement of the Mouat apparatus is very well illustrated diagram-atically in the sketch which I have had prepared, (Exhibit #7) in which all non-essential parts have been omitted chiefly for the sake of clearness. In this sketch we have the boiler represented by the large rectangular outline at the right of the sketch. That boiler is filled with water up to a level indicated by the dotted lines and by the letters "Water level." Above that is the steam space of the boiler. The steam is led from that steam space to the radiators in the house through the vertical pipe rising from the top of the steam space. After passing to the radiators the steam returns to the boiler through the ordinary return pipe, which is not shown on the drawing because it does not form any essential feature of the construction, but that return pipe will be brought down to one side of the boiler and lay under the boiler at or near its lowest level. For example, the condensation return pipe might be brought down here at the left of the drawing and connected to this horizontal run of the pipe (9), so that the water condensation would flow down through this pipe (9) into the
boiler.

39 The regulator device proper is the device which is shown
at the left-hand side of the drawing. It comprises, first, a receptacle which I will mark (6), using the same reference numerals as are found in the patent drawings. That receptacle is so placed that a portion of it is above the normal water level in the boiler, and it is connected to the water in the boiler by means of a pipe (9), which is carried up to a point above the bottom of the receptacle, and also above the normal water-level in the boiler.

The purpose of that feature of the construction is this: It is necessary, for reasons which I will explain presently, to have a normal or fixed water-level in this receptacle, in order that we may always secure, regardless of the water level in the boiler, a proper regulation of pressure for a given variation of the pressure in the steam space. By carrying this pipe up above the level of the bottom of the receptacle, and also above the level of the water in the boiler, we assure that fixed level, because whenever the water accumulates above that point it simply flows out by gravity through this pipe down into the boiler. And, on the contrary, any variation of the water-level in the boiler up and down cannot affect this level, because there is the same pressure on the surface of this water in the receptacle (6) as there is on the surface of the water in the boiler, that equality of pressure being secured by this communicating pipe which runs from the top of the receptacle (6), and which I will mark (11) to the steam space of the boiler.

Therefore, as I say, this particular feature of the arrangement
necessarily secures a fixed level of water in this receptacle
40 (6), and it is by virtue of the maintenance of that fixed level
of water in the receptacle (6) that we obtained the desired accuracy of regulation of pressure by means of the remainder of the device.

The remainder of the device consists simply of a second receptacle, which I mark (21), which is on a pivoted arm (20), and which is in communication with the water in the receptacle (6) through a flexible pipe (34) and the pipe (20), that communication being effected by means of a hollow trunnion, on which this pivot, that is the end of the pipe (34), enters the end of a hollow trunnion and the water in that pipe (34) passes through that hollow trunnion into the pipe (20) and then into the receptacle (21).

When steam has been generated in this boiler there is a certain pressure on the water in the boiler and that same pressure is exerted on the water in the receptacle (6). That pressure will force a portion of the water in the receptacle (6) up through this pipe (34), out through the pipe (20) and into the movable receptacle (21), and the water will stand in that movable receptacle at a height above the water in the receptacle (6) by an amount corresponding to the pressure of the steam.

For example, if we are carrying two ounces pressure of steam in the boiler, that two ounces pressure of steam will be sufficient to maintain a column of water about three inches in height above the normal level here (indicating); that is to say, the pressure on this surface forces the water up into this receptacle (21) until the water in the receptacle stands three inches above the level of the water in the receptacle (6).

Now, steam is continually condensing in this communicating pipe 11 by reason of the fact that there would be condensation of
steam in any pipe that extends out through the open air
41 and enters such a chamber as is formed by this heavy iron
box (6). That condensation is due simply to the cooling of the steam by the action of the air, and that condensation of the steam will supply continually water to this chamber, so that regardless of what water may be forced into this chamber (21), when we have a normal pressure, two ounces, the water will ultimately be

supplied to the chamber (6) as the generation of steam goes on until its level has risen to this overflow pipe. Then, if any further condensation occurs it will flow down through this overflow pipe into the boiler.

Now, what happens when the steam pressure in the boiler varies? Supposing it rises from two ounces to three ounces. Then there will be an increased pressure exerted on the air in this chamber (6) of one ounce, and that increased pressure of one ounce will support another inch and a half, roughtly, of water column in this chamber, that is, as the pressure here increases from two ounces to three ounces the height of the water in the chamber (21) will rise from a level of three inches above this surface to a height of about 4½ inches above this surface. Now, the moment that additional water is forced over this chamber (21), the weight of this movable chamber system is by that much increased, and here is a beautiful feature of the Mouat invention; the weight of the water that is forced over into that movable chamber is entirely determined by the size of the movable chamber. The pressure of the steam will maintain a column of water 4½ inches above this level in case the pressure is three ounces, regardless of what the cross-section of that column may be. That is, water presses only according to its height and not according to the cross-section of the column. Consequently, by making that 42 chamber large enough we can get any amount of water over into that chamber that we please, and by that secure any amount of added weight to that chamber that we please, so as to get any amount of force that is needed to move the chains and the other portions of this control apparatus.

So that by a very small variation of the pressure, say one ounce, we can force over into this movable chamber sufficient water to move all this heavy regulating device that controls the movement of the dampers of the furnace.

As I say, that additional inch and a half of water having been forced over into this chamber by the additional ounce of pressure, this chamber will fill by reason of the increased weight, and in filling will actuate these chains so as to open the stack damper and so as to close or possibly close the fire-box damper.

Those two movements together cut off to a certain extent the admission of air into the furnace, cut down combustion, and thereby reduce the heat supplied to the water and boiler.

Then, as the pressure falls again the pressure on this surface will be insufficient to maintain that 4½ inches height of water column in this chamber above this surface and a portion of that water will run back into this chamber again, lighten this movable receptacle, and it will rise correspondingly, closing the stack damper and correspondingly opening the fire-box damper.

In that very simple way, very accurate and reliable control of the fuel consumption is attained, with a correspondingly accurate control of the pressure in the vapor-heating system.

43 I should have explained, further, the necessity of using this chamber as affording a mean datum line, so to speak, from which the height of the water-column in the movable

receptacle 21 is secured. It might seem at first sight that you could get the same result by simply connecting this movable receptacle with the water in the boiler. Well, you could if this water level always remained constant; but it does not, it is continually varying. Even when a fixed amount of water is introduced in the boiler the water level in the boiler will vary every hour of the day, because the demands on the system vary. For instance, if we have only one radiator open, we have a certain amount of steam and the water level will be lowered by a certain amount. If we have ten radiators open we have to generate ten times as much steam and take off ten times as much water, and that will correspondingly lower the water in that boiler.

So this water level being continually varying, it would be impossible to get the accurate regulation of this movable receptacle by connecting it directly to the water in the boiler, because every time this water level varies the level in this movable receptacle correspondingly varies."

On further examination, Mr. Wadsworth testified that he had examined a number of the Hutchison Vapor Heating System installations if he remembered correctly, in November, 1915, and refreshed his recollection from a memorandum book. He testified that at the time these installations were examined by him, he made sketches. These sketches were offered in evidence by plaintiff's counsel and marked "plaintiff's exhibits four, five and six, respectively."

Witness was then asked to describe the installation at the National Savings and Trust Company Building, and witness referring
44 to the illustration of the essential features in the photographs
attached to the stipulation, marked "plaintiff's exhibit number 2", said that before proceeding with the description of that particular installation, he would make reference to the catalogue of the Hutchison System of Vapor Heating and he referred to pages 4, 12 and 13 of that catalogue, as well as to the illustrative diagram which he had prepared, as illustrating the characteristic features of the Hutchison device, which diagram was offered in evidence and marked "plaintiff's exhibit number eight". Mr. Wadsworth took the Hutchison catalogue, "Exhibit D" and the illustrative diagram of the Hutchison system, "plaintiff's exhibit number eight" and referred to the steam boiler shown on both of them and then marked the "separate independent receptacle" with the numeral (6), placing the reference numeral both on the diagram and on the illustration of the catalogue. He then referred to "Exhibit D" and testified as follows:—

"The Witness: That receptacle (6) is provided with a pipe which I have marked (9) that extends from the water space in the boiler to a point above the bottom of the receptacle (6), and also to a point above the normal water level in the boiler. The same receptacle is also provided with a connection 11 which extends from the upper portion of the receptacle to the steam space in the boiler.

Connected to the receptacle (6) through the elbow connection which I will mark with the reference letter A, and the flexible pipe connection (34), is a hollow tube (20) that extends to the receptacle (21).

This receptacle (21) is connected by means of chains to the fire-
box damper and to the stack-damper in such manner that as
45 this receptacle falls it will allow the fire-box damper to close
and will pull the stack-damper open. The action of this apparatus is the same as the action of the Mouat apparatus. When steam is generated in the boiler it will exert a pressure on the water in the top of the receptacle (6), which is maintained at a constant level in that receptacle by the presence of the overflow pipe (9) leading back to the boiler.

That pressure will cause the water to rise in the receptacle (21) to a height corresponding to the steam pressure of the boiler, that is to say, if the steam pressure of the boiler is two ounces the water in receptacle (21) will stand at a height about three inches above the water in the receptacle (6). If the steam pressure on the top of the water in the receptacle (6) is increased by one ounce, then the height of the water in the receptacle (21) will be increased by about an inch and a half, thereby increasing the weight of the contents of that receptacle, and the receptacle will move downwardly by reason of that increased weight. That downward movement allows the stack-damper to be opened and allows the fire-box damper to be closed, thereby reducing the consumption of fuel, and correspondingly reducing the generation of steam until the pressure falls to the normal, under which circumstances the water in the receptacle (21) will fall until its level is only three inches above the level of the water in the receptacle (6), instead of 4½ inches, as it would be at a three ounce pressure, and the receptacle will then rise by reason of the lightening of the load and the stack-damper will be closed and the fire-box damper will be opened, thus increasing the consumption of fuel.

Now, in the Bank installation as illustrated in the photographs,
the steam boiler is of the horizontal type and is indicated by
46 the large body at the lower left-hand side of the photograph.

The Court: Which photograph is that?

The Witness: The photograph No. 2, as I will mark it; rising from the top of that steam boiler is a large steam pipe which runs upwardly and then to the right—I am still referring to photograph No. 2—and then across the fore-ground in the picture. That is a steam pipe that runs to the radiators of the building. Running back from the right-hand portion of that steam pipe is another pipe, which I will mark (11), that pipe being the one which runs to the top of the trap receiver (6). That trap receiver is the circular chamber which is shown about the center of the photograph No. 2.

Running from the bottom of that receiver is another pipe, which I will mark (9), which is the pipe leading from the trap to the water in the boiler. The photograph, of course, does not show how that pipe extends up into the trap receiver, but I have examined the trap receiver of the Hutchison apparatus, and I find that its construction is properly illustrated by the illustrations on pages

12 and 13 of the Hutchison catalogue, which shows the pipe (9) extending upwardly through the bottom of the trap to a point at the top of the trap.

The movable receptacle of this Bank installation is best illustrated on photograph No. 1, in which I have correspondingly marked the trap receiver with the reference numeral (6) and in which I now mark the movable receptacle with the reference numeral (21). It is the large circular receptacle at the extreme right of the photograph. That receptacle is provided with a flexible hose connection, which I will mark 34. That permits it to rise and fall with
47 respect to the point of connection to the pipe I have marked 20′, and which runs back to the elbow connection that I mark A.

By reason of this flexible connection between the trap receiver (6) and the movable receptacle (21), this movable receptacle is allowed to fall and rise as the pressure in the trap receptacle (6) is increased, thereby forcing more water over into the movable receptacle (21), or, as the pressure in the trap diminishes, thereby allowing some of the water in the receptacle (21) to flow back again into the trap, that is to say, the receptacle (21) falls when the pressure in the steam space of the boiler and in the chamber (6) increases, and it rises when that pressure diminishes.

In all essential respects the Bank installation presents the features of construction and the characteristic mode of operation that I have described as distinguishing the Mouat apparatus.

Q. In making this examination of the Bank installation did you ascertain whether or not the pipe which you have marked on the photograph as (11) was inclined or horizontal? A. I made a careful examination of the arrangement of this pipe, both at the time of my first inspection in November, 1915, and also a couple of days ago. I examined this pipe by means of a level and I found on both inspections that the pipe was inclined from the steam space of the boiler toward the trap receiver, this inclination being found both in the long run of the pipe from the steam connection back to the elbow, and also in the short run of the connection from the elbow to the vertical portion of the pipe entering the top of the trap. That is to say, the portion of the pipe in the top,
48 photograph 2, ran downwardly from its connection with the main steam pipe to the first elbow; then downwardly from that elbow to the second elbow, where it entered the vertical run of pipe at the top of the trap receiver. So that the entire length of pipe would drain from the main steam pipe into the trap receiver."

Mr. Wadsworth was then asked to describe certain other illustrations and testified as follows:—

"Q. Will you briefly describe the Abercrombie installation? A. I did not make any detailed sketches of that installation, but to the best of my recollection it was one that corresponds very closely indeed to the illustrations on figures 12 and 13 of the Hutchison catalogue. It was one, at any rate, that presented all the characteristic features of the construction there illustrated.

Q. Did you test the pipe which connects the trap with the steam space of the boiler in the Abercrombie installation? A. I did. In that case I also found that the pipe running from the steam space in the boiler to the trap was inclined downwardly to the trap so as to drain towards the trap.

Q. Will you please briefly describe the Zellers demonstration installation which you examined in November? (Referring to Exhibits 4, 5 and 6.) A. The general features of that installation are illustrated in the first sketch, Plaintiff's Exhibit No. 6. The installation comprised an ordinary small-sized vertical steam boiler, to which was connected a control apparatus similar in all respects to the control apparatus illustrated on pages 12 and 13 of the
49 Hutchison catalogue. In this particular Zellers installation the inclination of the pipe which I mark (11), and which is the pipe leading from the steam space of the boiler to the trap receptacle (6), was very marked indeed, the inclination being so great that the bubble of the level that was applied to that pipe was thrown entirely out of sight at one end of the level glass. The other features of construction of this Zellers installation I will mark with the same reference characters that I have previously used in indicating the corresponding parts in the illustrations on pages 12 and 13 of the Hutchison catalogue.

I might say that this sketch does not show the chain connections from the movable receptacle 21 to the dampers, but those chain connections were present and they operated in the same way as I have already explained."

Mr. Wadsworth was then asked a series of questions to enable him to make a comparison between the illustrations in Exhibit D of the Hutchison catalogue, and the subject matter of the claims of the patent in suit and testified as follows:—

"Q. Will you please briefly describe the Hutchison demonstration installation? A. I made no sketches of that installation, but, as I recall it, it was one that presented an appearance almost identical with that of the illustrations on pages 12 and 13 of the Hutchison catalogue. (Exhibit D.) (Filed with the pleadings.)

Q. Referring to the illustrations in this Plaintiff's Exhibit D of the Hutchison catalogue, do you find that there is a receptacle corresponding with the receptacle (6) of the patent in suit? A. I do.

Q. Does the Hutchison system as illustrated in the cata-
50 logue before referred to employ a pipe connecting this receptacle with the water space of the boiler, and which extends above the bottom of the receptacle? A. Yes; that is the pipe that I have marked (9), in referring to the illustrations on pages 12 and 13 of the Hutchison catalogue.

Q. Is there in this Hutchison structure as shown in the catalogue, and in the various installations which you examined, a pipe connecting the upper portion of the receptacle with the steam space of the boiler and which will supply water of condensation to the trap? A. Yes. That is the pipe that I have already marked 11. I might say that that pipe will supply the water of condensation to the trap receiver.

The Court: Which pipe is that?

A. (Continuing:) Eleven, there (indicating on drawing). That pipe will supply water of condensation to the trap receiver regardless of whether the horizontal or nearly horizontal portion of the pipe that leads to the steam space is level or not; that is to say, regardless of whether that pipe may slope toward the trap receiver or slope toward the boiler. The reason for that is this: All of this space in the vertical portion of the pipe, and all of this space in the trap receiver above the water-level, is filled with steam, and all of that steam will be continually cooled by the action of the atmosphere and by such cooling will be continually condensed.

51 Now, all the condensation that occurs in this vertical portion of the pipe, and all the condensation that occurs in the top of this trap receiver will of course be collected in that trap receiver, and the condensation in the top of that trap receiver will be very pronounced by reason of the fact that the trap receiver presents a large cooling area to the air and the condensation there at that portion of the apparatus will be very decidedly more than it will be even in this pipe connection running back to the boiler.

That condensation in the top of the trap receiver would, in my opinion, be quite sufficient to supply any loss of water in that trap receiver that might occur through the evaporation or might occur through leakage in the receiver (21) or the joints connecting that receiver to the trap, and if it did supply such loss it would maintain that water-level in the trap constantly at the height of the top of the overflow pipe regardless of whether any other water condensation entered that trap or not.

Q. Does the defendant employ a movably supported receptacle to communicate with this first-mentioned receptacle which we have designated as (6), and if so, what is the purpose of its movement? A. Yes, the Hutchison apparatus has a movable receptacle which I have marked 21, and the purpose of that movable receptacle is by its rise and fall the actuation of the dampers which control the combustion of fuel in the boiler. The rise and fall of that movable receptacle is effected in the manner I have explained, by the variation of the steam pressure on the water in the receptacle 6.

52 Q. Are the functions of defendant's trap receiver, with its pipe connections to the boiler and of the regulator-bulb and the pipe connections between this bulb and the trap-receiver the same as the functions of Plaintiff's receptacle (6), pipe connections (9) and (11) and of Plaintiff's movable receptacle (21), and pipe connections between this movable receptacle and the stationary receptacle (6)? A. Yes; I consider the functions of those various parts identical in the two forms of apparatus.

Q. Does the trap-receiver or receptacle of the Hutchison device have a movably supported receptacle or regulator bulb connected therewith and is this movable receptacle arranged to drain into the former receptacle or trap-receiver? A. Yes. I omitted inadvertently to state that the movable receptacle (21), of defendants' apparatus, is placed at a height above the trap-receiver (6) so that when the pressure of the steam on the surface of the water in that trap is diminished, the water that is in receptacle (21) can flow back into the trap. That almost goes without saying.

Q. Are there in the defendants' device connections between this movable receptacle and the means for heating the boiler, and, if so, will you please specify them? A. Yes. Those are the connections that are afforded by the chains running from the strap that is attached to the receptacle (21) to the stack damper and to the fire-box damper. For convenience of reference I might mark these two dampers now with reference numerals 2 and 4, those being the numerals that are used to indicate the corresponding parts in the Mouat patent drawings.

By the Court:

Q. There seems to be a pronounced difference in the level with respect to that pipe (11) which goes from the steam receptacle of the boiler into this first outside receptacle, and the level of the other sketch. A. There has been no effort whatever made in this
53 diagram to indicate any inclination of that horizontal portion
(indicating).

Q. Oh, no, but there is in the other one. A. Yes, this sketch follows the patent drawings and in the patent drawings that pipe is shown as having a very decided inclination from the steam space toward the trap.

Mr. Brock: I would like to offer in evidence the two diagrams from which these enlargements were made, in order that your Honor may have convenient diagrams before you, these to be Plaintiff's Exhibits 7 and 8, Mouat diagram and Hutchison diagram.

(The diagrams referred to were marked by the Stenographer "Plaintiff's Exhibit No. 7", and "Plaintiff's Exhibit No. 8", respectively.)

Mr. Sturtevant: It may be understood that my objection extends to the accuracy of the Exhibit 8."

Cross-examination.

By Mr. Sturtevant:

Q. With reference to the installation at the National Savings & Trust Company, and particularly now referring to the pipe that you have indicated on the diagrams as (11), I understand you had to use a spirit level to ascertain the amount of gradation? A. Yes, sir.

Q. To ascertain that it graded? A. Yes, sir.

Q. What was the amount of gradation of that pipe? A. I
54 did not measure it in inches to the foot. It was sufficient to
throw the bubble of the spirit level about one-fifth of the length of the level glass away from the center. I would say roughly it was about half an inch to the foot, though it may have been less than that.

Q. How long was the pipe? A. Well, from recollection, I would say that the run of that pipe from the steam connection to the trap would aggregate in its different sections fifteen or sixteen feet.

Q. As a matter of fact, that pipe and the downward projecting part of it which you have shown there as (11) was covered with very heavy asbestos covering, was it not? A. It was when I last examined it. When I first examined it it was still bare.

Q. Of course the purpose of asbestos covering is to prevent condensation, is it not? A. Yes, sir.

Mr. Sturtevant: That is all.

Mr. Wadsworth testified on redirect examination as follows:—

"By Mr. Brock:

Q. Was the trap receiver in that Bank installation covered with any heat insulating material? A. No, sir.

The Court: You mean the box there, the receptacle?
Mr. Brock: The receptacle No. 6.

By Mr. Brock:

Q. Were the trap receivers of the other Hutchison installa-
55 tions which you examined covered with insulating material?
A. No, sir; I do not recall any instances in which they were.

Q. Were the Hutchison installations which you examined in operation at the time of your examination? A. Some of them were. The installation at Mrs. Abercrombie's house was in operation. The installations at No. 23 and No. 25 8th Street, S. E., Washington, and at 233 A Street, S. E., Washington, were in operation at the time of my inspection of them. I cannot recall definitely whether the Sellers demonstration installation was in operation or not when I saw it. The installation at the National Savings & Trust Company was not in operation when I first saw it, but it was in operation when I last saw it. The installation at the offices of the Hutchison Company was not in operation when I saw it.

Q. Did you note the temperature of the trap receiver when you made these examinations and when the installations were in operation? A. Yes, I did.

Q. What was the temperature of these trap chambers—what can you say of the conditions? A. The temperatures of the trap chambers was very much lower than the temperature of steam at even two ounces pressure. I had no thermometer with me at the time, but I tested the temperature by the sense of feeling, and I do not think the temperature of any of those trap chambers was above 150 degrees fahrenheit.

Q. What can you say as to condensation in the chamber under
those conditions? A. There would certainly be a very
56 marked condensation in the chamber because the temperature
of the steam at even two ounces pressure is above 212 degrees fahrenheit. It would probably be 213 degrees fahrenheit at that pressure. That would mean that there was a difference in temperature of over 60 degrees between the steam and the top of the trap receiver and the walls of the trap receiver as well as the water in the trap receiver. With that difference in temperature there would be a very marked amount of condensation of the steam that was in the steam space above the water (chamber 6).

Q. Suppose the pipe 11 comprises a horizontal member and a vertical member, what would be the effect of condensation so far as supplying the chamber with the requisite amount of water is concerned? A. All of the steam that was condensed in the vertical section pipe would of course drain immediately into the trap. If the pipe running from the vertical section towards the steam boiler was horizontal or was even slightly inclined upward the tendency would be for the water of condensation to move towards the trap receiver, because owing to the condensation of the steam in the top of the trap receiver, there is a continual flow of steam from the steam space in the boiler to the upper portion of the chamber 6.

Now, whenever the movable receptacle 21 is actuated by the forcing of water over from the chamber 6 into the receptacle 21 there is a sudden flow of steam from the steam space in the boiler into the top of the chamber, because the water that flows into the chamber 21, must be water that is displaced from the chamber 6, and the water that is displaced there of course increases the steam space in that chamber, and that must be supplied by a fresh flow of steam
57 from the steam space of the boiler.

Whenever there is a flow of steam through a pipe, the water of condensation in that pipe is naturally carried along in the direction of the flow of steam, and it in some cases, in many cases in fact, I have known the amount of condensation that is carried along in that way to be very marked, even when the pipe is inclined upwardly in the direction of the flow of steam.

Anyone who has had experience in steam heating systems, in which the steam pipe is used to carry the steam into the radiator and carry the water of condensation back from the radiator knows that in many instances the movement of the steam into the radiator will carry with it so much water in the pipe that the radiator will frequently be blocked, causing a hammering, that we so frequently hear in opening up a radiator after it has cooled down.

Q. In this movable receptacle 21, to which you have just referred, I note there is a valve shown in the top thereof. Will you please explain what that valve is for? A. That valve is shown in the Mouat construction, but not in defendants' construction. In the Mouat construction that valve is provided to prevent the escape of water from the movable receptacle 21, in case an abnormal amount of water is forced over from the chamber 6 into the receptacle 21. Where the fuel that is used under the boiler is gas and the control is used to open or close the valve in that gas pipe, the action of the apparatus is practically instantaneous in cutting off the fuel supply, and under those circumstances the water pressure in the boiler will begin to drop almost immediately after the closing of the valve in the fuel
58 supply pipe; but in the burning of solid fuel the closing of the fire-box damper or the opening of the stack damper does not immediately arrest combustion, and the steam generation in the boiler may continue after the closing of those dampers and raise the pressure in the boiler to such a point that the chamber 21 will be completely filled with water that is forced over from the chamber 6. In that case this valve is raised by the action of the float at the bottom of the valve closing the opening in the top of the chamber, so as to prevent

the escape of water under those circumstances, and the consequent loss of water from the stack.

Ordinarily that valve is open so as to expose the water in the receptacle 21 to atmospheric pressure.

Q. What is the pressure in defendants' regulator bulb above the water? A. Atmospheric; in defendants' regulator bulb there is a connection which leads from the top of the bulb back into this return pipe from the radiators, and that return pipe from the radiators is provided with a vent which is clearly shown in the illustrations on pages 12 and 13 of defendants' catalogue. It is marked in those illustrations "air vent", and that air vent is in frequent communication with the external atmosphere, so that the pressure on the top of the water in 21 (indicating) of defendants' apparatus, is atmospheric pressure, just as it is in the Mouat apparatus.——'

### *Defendants' Testimony.*

M. FRANK HUTCHISON, testified that he was engineer and secretary of the defendant, Hutchison Vapor Heating Corporation and he stated that in October or November about seven years
59 ago, he had installed in his house a "Precise Vapor System"
and he found that it backed the water out of the boilers up into the pipes and radiators and that he first hooked on a damper regulator connected with the boiler direct and brought it up with the water line of the boiler for use in regulation and then he designed the trap receiver referred to — exhibit, and that that prevented the backing of the water of the boiler into the radiators. He said he then removed the damper regulator from the boiler connecting it on the trap receiver and that his next step was the modulating valve and "that is the combination of what we term the Hutchison Vapor Heating system". He stated that at that time, the "Precise Vapor Heating System", was the only one known to him and that he had not heard of the Mouat Heating System. Mr. Hutchison testified that in the installation of the Hutchison Vapor Heating System, they now give specific instructions calling for the grading of the pipe from the boiler to the trap receiver with its low point next to the boiler. The witness produced an enlargement of one of the photographs of the National Savings and Trust Company installment and this was offered in evidence as "Defendants' Exhibit Number 1", it being such an enlargement of the photographs with sections of certain parts, so as to show the position of the water and the steam in these parts. Mr. Hutchison then went on to testify as follows:

"Q. What is the arrangement of the pipe in that drawing which corresponds to the pipe which has been referred to all along as pipe No. 11—that is, the pipe leading from the steam space of the boiler over the trap receiver? A. That pipe is taken out of the side of the supply main, and extends about seven and one-half feet back
60 to a point practically above the trap receiver. It has a grade
of about a thirty-second of an inch, as near as I can tell in one foot.

Q. A thirty-second of an inch in one foot? A. In one foot, and it is covered with three or four ply air sealed covering to prevent condensation.

Q. So far as the practical operation of this apparatus is concerned, is any grading of that pipe essential? A. No, sir.

Q. In ordinary steam engineering work, what is considered a grade? A. No less than one-half inch in ten feet on what we call a down grade, where steam and condensation are flowing in the same direction.

Q. In referring to this installation of the National Savings & Trust Company, how is the water supplied to the trap receiver? A. By the main return lines from the building—from the radiators throughout the building. All the condensation from the building comes back through the receiver.

Q. And with the installation there, about how much water is supplied per minute, or per hour? A. There is about 54 pounds of water per minute, which would be equal to practically, in round numbers, seven gallons a minute.

Q. And is or is not that sufficient to keep the trap receiver filled with water all the time? A. I should say it was. The capacity of
the receiver is about two and one-half gallons, I should judge,
61 and there is seven gallons a minute passing through it.

Q. Suppose there was some water passed into the trap receiver from this asbestos covered pipe, what would become if it? A. It would come right on back to the boiler, under average operating conditions.

Q. Mr. Wadsworth in his testimony has referred to some Hutchison installations, which I understand are those referred to in the bill of complaint, as at the house of Mr. Middleton at 223 A Street, Southeast, and also at houses 23 and 25 Eighth Street, Southeast. Will you explain just how the pipes are arranged in those installations, having particular reference to the pipe which runs from the steam space of the boiler to the trap receiver. A. In the house at 23 8th Street, Southeast, and the house at 25 8th Street, Southeast, there is practically the same construction. There is a vertical pipe which leads from the steam space of the boiler up probably six inches. There is a horizontal pipe from that pipe; a vertical pipe that drops from that down probably six to eight inches, and another horizontal pipe leading out, and another vertical pipe to the receiver. The two horizontal pipes grade towards the boiler; that is, towards the boiler as the low point, and the vertical pipes, of course, run vertically. Now, in the house at 223 A Street, Southeast, the connection is made from the vertical part of the supply main leading from the boiler, and that pipe runs horizontally to a point above the trap receiver, and down to the trap receiver with a vertical connection. The horizontal portion grades at least half an inch in
its length, which is possibly two feet, with the low point being
62 next to the boiler.

Q. In your apparatus, is there or is there not any function growing out of the gradation of the pipe between the boiler and the trap receiver? A. None whatever.

Q. What is the purpose of that pipe? A. That pipe is to supply pressure to the water in the trap receiver, and also to act as an auxiliary safety valve, so that, should the regular safety valve placed on the boiler become stuck or inoperative for any reasons, and the ash pit door left open on the boiler through accident or design, the boiler would get relief through that pressure pipe, through the trap receiver, and through the receiver column out to the chimney."

"Cross-examination:

Q. Mr. Hutchison, you stated that you first thought of your system about seven years ago. Can you state what control devices were in use at that time for low pressure heating systems? A. Why, I think I can, yes, sir.

Q. Just briefly? A. Broomell used a low pressure damper and regulator at that time.

Q. What was the general construction of that, just briefly stated? A. The general construction was the raising of water in a container at the side of the boiler, having a float on top of the water which traveled up and down as the pressure in the boiler raised that water or lowered it.

Q. Do you know of any other control device in use at the
63 time you began? A. I could not say positively that I do.
There were, however, others that have come to my attention since then that were probably in use at that time, but I could not make that positive statement.

Q. In the Middleton installation, as I understand your description of it, there are certain portions of the pipe which slant toward the boiler. Is that correct? A. Yes, sir.

Q. And these portions which will slant toward the boiler, there will be some condensation, will there not? A. Undoubtedly.

Q. Then there will be an accumulation of water in the portion that slants toward the boiler. Is that correct? A. An accumulation?

Q. Yes. A. No, sir; it will not accumulate.

Q. What will happen to it? A. It will find the lowest point and drop back into the boiler.

Q. How can it drop back into the boiler if there is a vertical pipe extending up there six inches, as I understood you to say, to the first horizontal flight of this pipe, or first substantially horizontal flight of this pipe? A. In Middleton's the main is taken off of the boiler first with a vertical connection, about a two inch pipe; then there is
a branch taken out of the side of that about two feet. That
64 pipe slopes towards the main, any condensation taking place
in the pipe running back towards the boiler.

Q. How about the second? A. That is bound to come down.

Q. As I understand, there is still another branch which extends out—— A. (Interposing.) No, sir.

Q. Not in the Middleton? A. No, sir.

Q. Was there in any of the other installations? A. In Bennett's.

Q. And was that inclined toward the boiler also? A. Yes, sir.

Q. And how would the water get out of that? A. The water would lay there.

Q. You are certain that it would not be carried out by the passage of the steam through that pipe? A. No, sir. It would lay there until it had found its level point, and then any there would have to drop over.

Q. Where would it go? A. It would go down into the top of the receiver, and then down into the top of the boiler.

Q. Into the receiver? A. Not into the receiver, but through the receiver and into the boiler.

Q. It would go towards the receiver? A. Yes, sir.

65 Q. Then, as a matter of fact, portions of that pipe drained toward the receiver? A. Well, you could not call that draining towards the receiver, either.

Q. They drained to the receiver? A. The condensation taking place in the pipe would drop through there, like it would on any vertical pipe.

Q. But it goes to the receiver? A. It goes to the receiver. Well, to get down to facts in this case, this water dropping down is hot. The water coming back in condensation is cold, and in the actual operation of the system this hot water is constantly dropping back into the boiler, and not stopping in the receiver at all, because the cold water from the system is always filling in at the bottom of the receiver, while the hot water on top is constantly dropping back. So that any condensation that takes place in the pipe would evidently pass right back to the boiler and not stop in the receiver.

Q. But it is drawn right into the receiver? A. No; it is drawn into this pipe here (indicating pipe in trap receiver connected with pipe 9).

Q. It is drawn right into the receiver from the pipe which connects with the steam space of the boiler? A. Yes, sir, and drops right through in here (indicating pipe in trap receiver connected with pipe 9).

Mr. Brock: That is all, your honor.

Mr. Sturtevant: That is all.

66 George H. Zellers, Jr., sworn, testifies that he has been for seventeen years engaged in work of installing heating apparatuses and is familiar with 'the Hutchison Vapor Heating System, having installed a number of plants; also that he is familiar with the installation at the National Savings and Trust Company Building, having installed the same. He further testified that the heavy layers of packing or asbestos covering up the pressure pipe leading from the main steam pipe to the trap receiver, were put on when the rest of the covering was put on the boilers. He stated that the horizontal pipe leading from the pressure pipe to the vertical pipe extending down to the receiver was inclined a little toward the trap receiver, but that such inclination was unintentional when the system was installed and was not in anyway necessary to the proper operation of the system. He further testified that this vertical pipe

leading down to the receiver is directly over the pipe in the center of the trap which depends downwardly therefrom and is of the same size, that is, each is a two inch pipe.

He testified as to the system installed at the Middleton residence, 223 — A Street, Southeast, Washington, D. C.—That the horizontal pipe leading from the boiler to the vertical pipe, the latter leading to the trap receiver grades away from the boiler; that is that the boiler is the low point, so that if there is any condensation in the horizontal pipe the water condensation would run back to the boiler.

As to the installations in the Bennett and Garber residences, 23 and 25 — Eighth Street, Southeast, respectively, the horizontal portions are just short pipes between fittings and he testified 67 that they were in fact, only short nipples, and by putting levels on them, it would show that they graded toward the boiler. He further testified as follows:—

"Q. What is the general custom in setting up these Hutchison systems? What do you do in regard to this pipe? A. We generally get as close connection to the boiler as possible with that steam balance pipe, for the rigidity of it, and also to go to get the least loss of pressure.

Q. Did you pay any attention as to which way it is to be graded? A. No, sir.

Q. It makes no difference? A. Not that I know of; no, sir.

Q. How is the trap kept filled with the water? A. It is supplied by the condensation coming back through what we call the main return line."

Cross-examination:

On cross examination, witness Zellers stated that the total difference between the upper end of the steam pipe and the lower end of the vertical pipe, where it enters the trap, is approximately about four feet. As to the demonstration installation, he stated he did not remember whether there was considerable of an inclination between the steam space of the boiler and the trap receiver; he also stated that they never considered that pipe was anything but a balance pipe for steam balance and generally made as a direct connection as they could for it to be rigid to the trap receiver as a support.

68 Defendant's counsel offered in evidence, certified copy of the file wrapper and contents of the patent in suit, showing the history of the case during its prosecution in the Patent Office and it was marked "Defendant's Exhibit Number Two".

Arthur S. Brown, for defendants, being sworn testified that he was a patent solicitor and expert; that he had read and understood the patent in suit and had examined and understood the alleged infringing structure and that he had made a study of the prior art, particularly as to patents set forth in the answer filed by defendants.

Mr. Brown was then asked to refer to the prior art or such portion thereof as he might think proper, comparing the plaintiff's apparatus with respect to the defendant's apparatus, pointing out wherein the two apparatuses differ from each other, differ from the prior art or resemble each other. Mr. Brown thereupon answered as follows:—

"A. Before referring to any patent in the prior art, I wish to first call attention to the necessity in the apparatus of the Mouat patent for supplying water to maintain the trap receiver (6) sufficiently full of water for operative purposes. This receiver (6) of the Mouat patent is provided with a special filling aperture, which is not shown in this drawing, plaintiff's Exhibit No. 7, but is shown in Figure 2 of the drawings of the patent in suit—if I may hand your Honor a sheet containing those drawings (handing paper to the Court)—and which for convenience I have indicated the water in blue and the steam is yellow, to facilitate reference to it, and your Honor will look at Figure 2, at the top of the receiver (6), and just to
69 the left of the yellow pipe (11), your Honor will notice a plug (8).

The Court: Yes, sir.

The Witness: That could be removed in the first instance in starting up the apparatus for the purpose of supplying that receiver (6) water, filling it up until it overflows. Now, that water may be constantly lost through evaporation in this Mouat construction, because the rising and falling bulb (21) shown at the extreme left of figure (2) of the drawings, is constantly open to the outside air, through the aperture (26). So that, as that water is heated, there can be a constant loss of water by evaporation through that open vent.

The Court: Where is your aperture (26)?

The Witness: You will see it there.

The Court: Yes, I see it.

The Witness: And it is shown here in this drawing. In fact, that aperture is always open, except in the contingency that there may be an excessive pressure over what is normally expected, in which event the bulb (21) will be entirely filled with water, and a float (30) will be lifted and close that vent (26) by means of the valve (29), which your Honor sees in figure (2) of the drawings, and it is primarily because of that constant loss of water through evaporation that Mouat has to make a special provision for replenishing the water in the receiver or receptacle (6), and he does that by providing the long inclination of the exposed pipe (11), so that the steam will condense in that pipe (11) and be discharged into the receptacle (6) fast enough to compensate for the loss of water through evaporation, and of course if any excess water is supplied to
70 the receiver (6) it will overflow through the pipe (9).

Your Honor will note from figure 3 that the overflow pipe (9) extends out from one side of the receptacle (6), whereas the steam entrance pipe (11) enters immediately at the top, so that any water condensation dropping from the steam pipe (11) will necessarily enter the receiver, so that any surplus quantity will then overflow through the overflow pipe (9) and back again into the boiler.

Now, the first patent in the prior art to which I will call attention is Roy patent 632,671, dated September 5, 1889, for automatic damper regulator. For convenience, I have had all of the drawings of this Roy patent mounted on a single sheet, so that it can be readily handled, and I have also colored the drawing with blue and yellow. The blue representing water and the yellow representing steam.

Roy illustrates three different plans for regulating the furnace, and I will call particular attention to the plan which is shown in figure 3 of the drawing, because in that system shown in figure 3 there is present practically the same character of separate trap reciever or receptacle 43 which is employed in the Mouat construction. Your Honor will note that there is a steam pipe (2) in figure 3 which rises directly from the steam space (1) of the boiler, and that has a horizontally extending branch pipe, which is marked (2-11)—a large two below and a small eleven above—which extends to the left, and then has a vertical branch pipe which extends upwardly through the bottom of the trap (43) and up to the upper portion of that trap above the water-level, as illustrated in that figure. The result is that the steam-pressure is applied to
71 the top of the water in trap (43) and that pressure has a
tendency to discharge the water through the second vertical pipe (10-11) which opens near the bottom of the reservoir (43) and extends upwardly and out at the top. Do I make that construction plain?

The Court: Yes. I follow you very well.

The Witness: Assuming for a moment that there is pressure enough in the receiver (43) sufficiently to cause a flow of the water, and that conditions are otherwise present to cause the flow of the water, the water will be forced from the trap receiver (43) upwardly through the pipe (10-11) and then, if your Honor will refer to figure 5 of the drawing, which is a cross-section through the standard (11) shown in figure 3, you will see the course of the water. The water passes upwardly through the standard (11-11), thence horizontally into the chamber (14-11), and thence outwardly through the pipe (10′). That pipe (10′) is the gauge shown in figure 3 of the drawings extending from the standard (11) to the right and into the bottom of the bulb (17). Does your Honor notice the bulb (17)?

The Court: Yes, I notice it.

The Witness: The horizontal pipes shown in figure 5 are mounted in bearings, so that they can rock in those bearings back and forth. Now, if water is forced by the steam pressure into the bulb (17) in sufficient quantity that the bulb (17) will drop from the position shown in figure 3, and through the chain connections which I illustrated in figure 1 of the drawings, the damper illustrated (25) will be properly moved, so as to check the draft of the furnace, and consequently reduce the temperature of the fire. Then, when the
72 temperature of the furnace is lowered and th steam pressure is
thereby reduced, the water will flow back again from the bulb

(17) back to the pipes (10′) and the passages (14-11) and (11-11), back again into the receiver (43). So that the action of the apparatus, including the trap receiving chamber, and the rising and falling bulb, is just the same in this Roy construction as it is in the Mouat construction in the regulation of the furnace; that is to say, as that bulb rises and falls, depending upon the steam pressure, the damper is opened and closed, of the furnace, in a proper way, so as to either check the combustion or to increase it.

Roy was confronted with the same problem which Mouat was confronted with, and that is the necessity of so constructing and organizing this bulb (17) that water can freely flow into and out of it. If that bulb (17) or the chamber (21) of Mouat was entirely closed, so that it contains a closed body of air, the water could not fill it, and then make it again empty, because it would be air-bound. The effect of the water rising in it would simply be to compress the air until the pressure of the air offset the steam pressure, and there would not enough water get into the bulb in order to bring about this operation, and it was primarily for that reason that Mouat provided this constant vent at (26) for this bulb, so that, as the water enters this chamber, the air can escape from it and not prevent the entrance of the water, and Roy was also confronted with the same problem which Mouat was, and that is the necessity for keeping a sufficient quantity of water in the trap receiver (43). Primarily Roy, in starting his apparatus, depends upon the condensation of the steam in order to fill a trap-receiver with water; but Roy does not maintain his bulb (17) in constant communication with the open air. He has,
73 as your Honor will note in figure 3, a small valve, which has no number there, but a similar valve is shown at (18) in figure 1, which, in the first instance, in starting the apparatus, is opened so that the steam may drive the air out of it, and therefore during the operation of the apparatus, that bulb is filled either with steam or with water, as the case may be. In order that this apparatus, having that normally sealed bulb (17) may work properly, Roy has this plan: As your Honor will see from figure 3, the top or upper end of the rising and falling bulb (17) communicates with the similar bulb (2′). That steam pipe extending from the right to the left, and as shown in figure 5, that steam (2′) enters a chamber (14′), shown in figure 5. It is colored yellow in the drawing before your Honor, and that chamber (14′) communicates with the passage (9′) in the vertical standard at the left of figure 5, and at its bottom it communicates with the pipe (2) leading up from the steam space of the boiler, as also shown in figure 3, so that the steam from the boiler—referring to figure 3—passes vertically through the pipe (2), thence horizontally through the same pipe (2); then referring to figure 5, the steam passes through the vertical standard (9′), thence horizontally through the chamber (14′); thence outwardly through the pipe (2′); and thence to the top of the bulb (17). The pipe (2) in its horizontal branch shown in figure 3 of the drawing is provided with a valve (6). Your Honor will note the numeral 6 in figure 3 of the drawing, and that valve is shown in detail in figure 1 of the drawing. Ordinarily, that valve is entirely

open, so that there is a free passage of steam to the top of the bulb
(17), and consequently the steam entering the bulb (17) con-
74 denses and can flow down through the water passages back
into the trap receiver (43), and if it overflows, the water
overflows, through the vertical pipe in the receiver, and thence back into the boiler.

There is also a second branch steam pipe, which is shown at (3) in figure 1 of the drawings, and is also illustrated in figure 3 of the drawings, and has no number to it. You will notice that second steam pipe in figure 3? It is a horizontal pipe, a little below the horizontal branch of pipe (2). That steam pipe extends to a diaphragm valve which is shown—it is simply indicated in figure 3, but it is shown as (4) in figure 1 of the drawing—and that is a rising and falling diaphragm, which acts upon a weighted lever (5) shown in detail in figure 1, and also indicated in figure 3 of the drawings.

In the event that the steam pressure in the boiler rises to an excessive amount, so that the furnace could be checked, that diaphragm lifts under the steam pressure, and as a consequence the weighted lever (5) is lifted, and as that weighted lever is indicated to the valve (6), the valve (6) is closed, so that steam can no longer pass into the bulb (17). The result is that the steam already in the bulb (17) will condense rapidly, creating a partial vacuum, and then the steam pressure acting on the top of the water in the trap receiver (43) will force the water into the bulb (17) overweight the bulb (17), the bulb will drop down, and control the damper in the proper way to check the fire in the furnace. Then, when the steam pressure in the boiler falls, the reverse action takes place; that is to say, the weighted lever (5) presses downwardly the diaphragm (4), and as the result of valve (6) again opening, steam
under pressure passes to the top of bulb (17), and the water
75 then being balanced by equal pressures in the bulb, and on
its surface, the water by gravity flows back into the trap
receiver (43), and by reason of that particular organization Roy obviates the necessity of having any continuously open aperture in his bulb (21), and he is continually supplying water condensation to the trap receiver (43) through the condensation of the steam in the rising and falling bulb (17). So that that trap receiver is kept constantly full of water, to the requisite extent, and any surplus water collecting in the trap receiver overflows back into the boiler again, in just the same way as any surplus water of condensation in the Mouat system overflows back into the boiler, there being simply this difference, that in the Mouat system the overflow passes back to the boiler through a separate pipe (9), whereas Roy utilizes the same pipe for supplying steam to the trap receiver and for permitting the surplus water to overflow back into the boiler.

The Roy patent thus shows the same general system of regulation; that is to say, he has a rising and falling bulb, mechanically connected to the damper of the furnace for controlling it, opening and shutting it in the proper way. That bulb receives the water from a trap receiver (23), which is a separate entity, and separate from the boiler itself, and that trap receiver is connected by a pipe, so as to receive steam pressure on its upper surface for forcing the water from the trap receiver up into the bulb, and it also has an overflow pipe to permit any surplus water from the trap receiver from flowing back into the boiler again.

And also Roy, as Mouat, keeps his trap receiver full of water by the condensation from the steam. The Roy regulator is one
76 that is obviously intended to be used with a system of heating, wherein there is considerable steam pressure, because the action is dependent upon the steam pressure being sufficiently adequate to move the diaphragm up and down to overcome the weighted lever and also to lift and move up and down the valve (6), which controls the flow of steam from the steam space of the boiler to the bulb.

But the Mouat patent is not, the first instance in the art of a vapor system, as distinguished from a steam system, in which there is a substantial amount of steam pressure. In order to show the character of steam heating apparatus of the vapor type, the type which is used by the defendant. I shall refer to two patents by Broomell, No. 650,778, dated May 29, 1900, and No. 717,335, dated December 30th, 1902. In the drawings of this patent, I have indicated by blue water and yellow steam, so as to facilitate reference to them. I must say that I have seen an apparatus similar to what is shown in the second Broomell patent 717,335 in operation at the Congress Hall, New Jersey Avenue just below the Capitol, where this Broomell system is in use. If your Honor will first refer to the drawing of the first Broomell patent, No. 650,778, which illustrates the general system, the boiler is shown at (A)—these are all large letters—and figure 2, and also on a smaller scale but without a reference character, in figure 1, which illustrates the basement and the three stories of a house, the steam from the boiler as shown in figure 2 raises through the vertical pipe (B) shown in yellow in figure 2, and there shown as having branches leading off to the radiators in several of the rooms of the house, which are shown at (D) in figure 1, the yellow lines indicating the steam supply to them and
77 the several radiators (D) all drain backwardly to the boiler through the pipes (F), which are indicated in blue in the drawings. The return pipes (F) from the several radiators do not go directly to the bottom of the boiler, but they go through a receiver shown at (G) in figure 2, and on a larger scale in figure 3.

If your Honor will refer to figure 3, you will note there are a number of holes (F′) shown in figure 3, which are the holes to receive the various water return pipes from the several radiators of the building, there being six of those holes (F′) indicated in figure 3.

I will note for the moment that the central hole (H′) is for a different purpose, and is not a return pipe connection from the radiators. Water of condensation from the radiators thus goes to this receptacle, shown in figure 3, and from the bottom of the receptacle the water of condensation passes downwardly through the vertical pipe (G-2) shown in figure 2, to the water space of the boiler. Do I make that clear to your Honor?

The Court: Yes.

The Witness: The Broomell patent here thus shows a system wherein all of the water of condensation from the radiators throughout the building passes through a chamber which is used as a regulating chamber, as I shall call attention in a moment before passing to the boiler, and in that connection I may say I *i*mphasize that point at the present moment because I shall subsequently point out in the defendant's apparatus there is a similar organization; that is to say; in the defendant's apparatus all of the water of condensation from the heating radiators throughout the building is brought back through this trap receiver (6), before it returns to the water
78 space of the boiler. This trap (6) in defendant's apparatus
being used for the purpose of regulation, just as in Broomell, the chamber (G) is used for the purposes of regulation.

I will not refer particularly to the regulation system shown in this Broomell patent, because the second Broomell patent, 717,335, December 30, 1902, is the one to which I shall particularly call your Honor's attention. If your Honor will refer to figure 2 of that drawing—the drawings of that second Broomell patent—you will note the inclined pipe (D), above which are the words "return water pipe". That is the pipe through which all of the water from condensation from all the radiators in the building passes through on its way to receptacle (B), and as shown in figure 1, the bottom of that receptacle (B) is connected, through the pipe (B′), with the bottom of the water space of the boiler. Also at the point of juncture between the return water pipe and the chamber (B) is a vertically rising pipe (E) opposite which the words "air vent" appears, and that pipe has several back and forth branches, so as to save to some extent as a heating radiating pipe, and its open end extends to the furnace flue, which is so designated in figure 2 of the drawings.

The consequence is that the return system is always open to the air through the furnace flue, so that it is impossible for any excessive pressure to exist in the system, and consequently the system is a low pressure vapor heating system of just the character which the defendant employs, the substantial difference between the defendant's apparatus and this Broomell apparatus simply being in the particular means of regulation which is employed.

In this Broomell case No. 717,335, the regulation is effected by means of a ball float (G), which is located within this
79 chamber (B), through which all of the return water of
condensation passes, and it rides upon the water in the receptacle (B). Your Honor will note that by reason of the communication between this receptacle (B) and the boiler itself, the water in the receptacle (B) is always subject to the pressure of the steam within the boiler through the water in the boiler. You will note the word "water level" indicating the level of the water in the boiler, and the water level in the chamber (B) is a varying level, depending upon the pressure. Your Honor will note in figure 1 a scale on the side of the chamber (B), on which ounces of pressure

are indicated, and as shown in the drawing, the water level in the chamber (B) is at the eight-inch point, which signifies, as shown there, that there is a steam pressure of eight-inches within the boiler, and consequently the water column in the chamber (B) stands at a height of eight inches above the water level in the boiler. If the steam pressure increases, the water level in the chamber (B) will increase. If the steam pressure within the boiler decreases, the water level within the chamber (B) will decrease. Consequently, by having a float (G) which floats on the water in the chamber (B), that float will move up and down to a degree depending upon the variation in the steam pressure. That is, if the steam pressure in the boiler increases, the float will rise; if the pressure decreases, the float will fall; and that rising and falling of the float is utilized to control the dampers, as your Honor will note from figure two. The float is connected by a chain (*g*) which passes out of the top of the chamber (B) and over the pulleys and down to the damper of the furnace, so that, if the float rises, through an increase of
temperature, the damper at the bottom of the furnace will be
80 closed, and as the result, the heat will be checked because the
air cannot be passed into the furnace. On the other hand, if the steam pressure falls, the float will fall and the damper will be lifted, thus opening up the draft and increasing the heat applied to the boiler.

So that Broomell shows the general character of the vapor heating system used by the defendant, and also goes further in resemblance to the defendant in having the chamber which is the regulating chamber and through which all condensation from the radiators in the system extend.

I next call attention to the Deitrich patent 704,623, July 15, 1902, and I have adopted the same color scheme of blue for the water and yellow for the steam, and it shows a system very similar to the Broomell system to which I have just referred, and I call attention to it simply for one additional detail, and that is to say, in the Broomell patents to which I have referred, there is only one of the furnace dampers that is acted upon, and that is the one at the bottom of the furnace. Deitrich shows a system where both the flue damper and the furnace damper are automatically controlled by the regulator. The regulator works on just the same principle in Deitrich as in Broomell, there being a float which rises and falls with the variation of the water level due to the pressure.

I will next call attention to the Shurtleff patent No. 781,467, January 31, 1905, which also is a steam heating apparatus of the vapor type, and in which the regulation is by a rising and falling bulb (I) shown in figures 1 and 2 of the drawings, that bulb is similar in cer-
tain respects to that used by the defendant, because the bulb
81 is connected by flexible connections at (M) and (N), the
connection at (M) being to the water, and the connection at (N) being to the open air through the venting pipe of the system.

I will call your Honor's attention to figure 1 of the drawings of this Shurtleff patent. The boiler is shown at (A), and there is a vertical rising pipe (F) shown in yellow, which extends from the steam space of the boiler and connects at its top with the pipe (F) at the left, which leads upwardly to the radiators. I will ask your Honor to ignore for the present the radiator (C), which is at the right in that figure. The main flow of steam is upwardly from the boiler through the pipe (F), and the branches to the radiators, shown horizontally on two floors at (B) and (B′), and the water condensation from the radiators flows through the pipes (G) back first to the horizontal pipe (E) and thence through the vertical pipe (E) to the water space in the lower portion of the boiler, so that there is this same character of the flow of steam, and of water condensation, as in the defendant's apparatus.

Also, if your Honor will note, the horizontal extension of the pipe (E) which extends to the right at figure 1 of the drawings, you will note that that pipe communicates with the pipe (F′); that pipe (F′) extends up to the top of the radiator (C), and that radiator (*c*) communicates through the pipe (H) with the draft flue (D), through which the products of combustion from the boiler passes; so that the system is always vented through this radiator (*c*), and to the flue of the chimney, in just the same way in principle as in the Broomell patent, so that there can never be any excessive steam pressure in the system, and it is to that ever-always open pipe system that the rising and falling bulb (I) is permanently connected by means of the flexible indicator (M), shown at the right-
82 hand upper portion of figure 2. The lower portion of that bulb (I) is indicated by the flexible pipe (M), with a branch water-pipe (M′), which, as your Honor will note from figure 1, connects with the vertical pipe (E) leading to the bottom of the boiler.

So that the action of Shurtleff, so far as effecting regulation is concerned, is precisely the same as in the defendant's apparatus, with this one exception, and that is Shurtleff utilized the water in his boiler to effect the regulation instead of having a separate chamber at the side, as Roy and in Mouats'. The action is this: The steam pressure within the boiler will maintain a higher pressure in the vertical pipe (E) by reason of the fact that the pipe (E) always communicates to the open air through the passages which I have already referred to.

Assume that normally the pressure in the boiler is sufficient to bring the water up to the level of the lever (J), which carries the bulb (I), in that event the condition will be that shown in figure 2 of the drawings, in which the bulb (I) is just half full of water, and just sufficiently full to be counterbalanced by the weight (L). If the steam pressure in the boiler increases, the water in the pipe (E) will rise, will flow through the pipe (M′), to the flexible connection (M) into the bottom of the bulb (I), and there being thereby an increased weight of water in the bulb (I), it will descend, and as the result of that descent, it will control the dampers of the furnace in the manner indicated.

If your Honor will refer to figure 2, there is a damper (S) shown in the flue leading from the furnace to the chimney, and that damper is connected by a crank-rod (*s*) and a vertically extending
83 rod (R) to the lever (J), which carries the hollow bulb (I). The consequence is that if the pressure in the boiler increases,

and more water enters the bulb (I), the bulb will move downwardly, carrying with it the rod (R), and as a result, controlling the damper, in this instance by closing the draft in the furnace, so that the draft, being checked, the fire lowers, the pressure in the boiler decreases, and the result of the decrease of pressure in the boiler is to maintain a shorter column of water in the pipe (E), which drops, and consequently the water flows out from the bulb back into the pipe (E), so that the bulb is overweighted by the weight (L), so that the lever (J) swings into the opposite direction, thus opening the chamber (S), and increasing the draft through the furnace.

In this case there is no necessity of any special means for maintaining the bulb filled with water, because all of the water of condensation from the radiating system passes downwardly through the pipe (E), and the pipe (E), being in communication with the water pressure in the boiler, always has sufficient water to supply the bulb.

Also in this case, as the defendants' apparatus, there is no necessity for keeping the bulb closed at the top at any time, because it opens through the flexible pipe (N), communicates with that with the same pipe system, which leads to the water float, just as in the defendant's system the bulb (21) is permanently connected by a flexible pipe to a pipe which leads to the open air. That feature is not shown in this drawing. I do not know from this drawing, Exhibit 8, whether the pipe shown at the top is intended to be the vent pipe, or whether it is intended to be the return pipe from the radiators.

If your Honor will turn to Plaintiff's Exhibit D, on page
84 4 of the catalogue, that shows the general system. The steam which is here indicated by the word "vapor" in the upper part of the boiler, passes upwardly through the vertical pipe, and thence, as shown, comes up to the top of the radiator, which is indicated at the upper portion of the figure. The water of condensation passes downwardly through the vertical pipe at the right of the figure, to the bottom of the trap; thence overflows the trap and extends downwardly to the lower portion of the air space of the boiler. About the middle of that vertical pipe, which has the words "air condensation" opposite it, your Honor will note a pipe which is horizontal and then upwardly and marked "air pipe". That pipe goes into the chimney, and is always open to the air, so that there can be no excessive pressure.

Mr. Wadsworth suggests that I add to Exhibit 8 an air vent. It will do that by putting a pipe at the top and marking it "air-vent." The pipe which I have marked (R) represents the return pipe bringing back the water of condensation from all the radiators in the building. It brings that water of condensation back through the trap (6); thence down to the water space of the boiler, and it is always vented to the air by the air-vent pipe leading to the chimney, so as to prevent any excess of pressure.

Defendants' Exhibit No. 1, which is a photograph of the installation at the National Savings & Trust Building in this city, shows the corresponding vent-pipe by the word "vent" at the top, and that is the pipe which leads into the chimney, and is shown as connected to the return pipes which are marked with the word "return," through which all the water of condensation from the radiators throughout the building flows back into the boiler.

85 Now, I think that with those references to the prior patents, it will be evident that there are certain characteristics, at least, in the defendants' apparatus, which are similar to those shown in these prior patents. In the first place, the defendants' vapor system of the entire apparatus is in accordance with these prior patents of Broomell; that is to say, by reason of the fact that the return system is vented to the atmosphere, there can never be any excessive pressure in the system, and in the next place, the regulation of the system is all through connection with the return system which returns the water of condensation from the radiators of the building back to the boiler again; and, in the next place, the defendant uses a rising and falling bulb, which receives the water or discharges water for the purpose of moving up and downwardly, of the same character which is, generally speaking, in the Roy patent, and more particularly of the same character as in the Shurtleff patent, because in the defendants' rising and falling float, as in Shurtleff's patent, the top of the float is connected by a flexible pipe with the return pipe, and thence to the open air through the vent. That is well shown in the large drawing to which I have applied certain reference letters. (H) is the rising and falling bulb, and it is connected by the flexible pipe (J) with a horizontal pipe (K), which leads to the return pipe (C), through which the water of condensation flows to the boiler, that return pipe being vented to the open air through the vent, in which respect the defendants' apparatus is just like Shurtleff's patent to which I have referred.

Also the lower portion of that bulb is connected by a flexible pipe (I) with a horizontal pipe (G), which is connected also to the return pipe (C), through which all of the water of condensation
86 comes back to the boiler, in which respect the defendants' system is similar to the Shurtleff patent, wherein the lower portion of the bulb connects by flexible pipe (M) with a horizontal pipe (M′), which leads back to the return pipe, which carries the water of condensation back to the boiler.

The only difference between defendants' apparatus and the Shurtleff apparatus is that in the Shurtleff apparatus it is the water directly from the boiler itself which is forced into the bulb for the purpose of filling it with water, and which flows back again directly into the boiler when the temperature conditions are right; whereas, in the defendants' apparatus, the water which is forced into the bulb by the rise of steam pressure is water which is contained in an independent trap shown at (D) in this drawing, in which respect the defendants' apparatus is similar to the Roy patent, Roy being the first instance in the art of using an independent receptacle to contain water to be forced into a rising and falling bulb.

In the defendants' apparatus, as in the Roy patent, the upper portion of the trap shown at (6) in this Exhibit No. 8 connects with the steam space of the boiler, so that the steam acts upon the upper portion of the water in the trap, so that in case it increases, that water can be forced into the bulb, and that when the steam pressure decreases, the water flows back from the bulb into the receptacle (6), and if there is any surplus water it overflows into the boiler.

But there is this important distinction between the defendants' apparatus and either the Roy or the Mouat patent, and that is in the manner in which the trap is kept full of water. In the
87 Mouat, the trap is kept full of water solely by reason of the condensation of the steam in the communicating pipe (11), and that communicating pipe (11) is especially designed for the purpose of supplying water of condensation to the trap. If it was not for the fact that water of condensation is supplied to the trap by that special means, the trap would lose its water by evaporation through the always-open aperture in the rising and falling bulb, and the apparatus would soon become stale and become inoperative.

Accordingly, Mouat has devised a particular scheme of having a long inclined exposed pipe leading from the steam space down to the top of the receptacle so that it acts as a condenser to condense the water in the steam and supply it to the receptacle. Except for that fact, the receptacle might have been placed immediately adjacent to the steam space, with a direct connection with the steam, and so in Roy, Roy had no way of keeping his receptacle full of water, except by water of condensation in the steam. So he makes provision for returning the water of condensation of the steam into his receptacle for the purpose of keeping it full.

But in the defendants' apparatus there is no problem presented of keeping the trap full of water, because through that trap passes all of the water of condensation from the entire radiating system in the building. All of the radiators in the building do their heating by the condensation of the steam in them, and the water of condensation from all of the radiators passes through this trap (6) on its way to the bottom of the boiler. So that trap (6) would be kept full of water if there was no pipe (11) present at all in the
88 apparatus. That pipe (11), so far as any supply of water of condensation is concerned, might be wholly eliminated from the apparatus. The sole purpose and sole operative function of the pipe (11) in the defendants' apparatus is for the purpose of putting pressure on the top of the water in his trap, just as was the case in the Roy patent, and thereby maintaining a column of water in the connecting return pipe, and it is of no value in the defendants' apparatus that there may be some water of condensation deposited in the pipe (11) and thence drop.

In the installation at the National Savings & Trust Company, every effort has been made to prevent any water condensing in that corresponding pipe (11), because that corresponding pipe is encased in a thick asbestos case, so as to prevent radiation, and the loss of heat, and to restrict any condensation which may occur there to a minimum extent. So that any water which does condense in that steam pipe is a wholly negligible quantity, so far as the trap is concerned, for two reasons: In the first place, it is negligible, because more than enough water is being constantly supplied to the trap from the radiation system in the building; and, in the second place, the defendants' organization is such that the pipe (11) is in vertical alignment with the discharge pipe (9), which comes down to the bottom of the boiler, so that any water of condensation flowing downwardly through the pipe (11) will drop right straight down through the pipe (9), and will not pass into the trap itself unless, indeed, it should happen to be in such a very restricted quantity that it would hang to the connecting surfaces by capillary attraction.

89 So that the very fact that the pipe (11) is in vertical alignment with the pipe (9) shows that no reliance whatever is placed upon any water condensing in pipe (11) as to be a factor in filling the trap (6), and that any water, if it did get out of trap (6) from that source, it would be wholly inconsequential, because that trap is more than kept full by the water of condensation coming from the radiating system; whereas, in the construction of the patent in suit, the Mouat construction, it is absolutely essential that the connecting steam pipe (11) should be especially designed to act as the condenser for the purpose of supplying water to keep the trap (6) filled, because there is no other way, after the apparatus is started, of getting water into that trap, and it is constantly evaporating through the open vent of the bulb.

Mr. Sturtevant: I offer in evidence the patents which have been referred to, the Roy patent No. 632,671, as defendants' exhibit No. 3; the Broomell patent, No. 650,778, as defendants' exhibit No. 4; the Broomell patent No. 717,335, as defendants' exhibit No. 5; the Dietrich No. 704,623 as defendants' exhibit No. 6; the Shurtleff patent, No. 781,467 as defendants' Exhibit No. 7. I also offer as defendants' exhibit No. 8 as a whole the colored drawings of these respective patents, as well as the patent in suit, which have been referred to by the witness Brown in his testimony.

By Mr. Sturtevant:

90 Q. Referring to the patent in suit, there seem to be a number of elements of construction to which you have not referred. Will you explain which is the part which is indicated by the numeral 10? If you have referred to it generally, in your former answer, please refer to it a little more specifically. A. The part 10, which is shown at the lower right-hand corner of figure 3, is a check valve in the overflow pipe (9), which is described in the patent as having the function of preventing the water in the boiler being forced from the boiler upwardly through the pipe (9) and sent to the receptacle (6).

Q. Is this part, or a similar part, present in the defendants' structure (6). A. It is not.

Q. Is it present in the structure shown in the Roy patent? A. It is not.

Q. I will ask you the same questions with reference to the part marked 37 in the Mouat patent. Explain what that is and note whether it is present in Roy or in the defendants' structure. A. No. 37 is shown at the upper right-hand corner of figure 1 at the bend in the pipe (11). It is described as a valve, having as its function the venting of the pipe (11), in case there should be a vacuum in the boiler, or a pressure less than the atmospheric pressure, and by reason of the fact that the valve is there, the receptacle (6) cannot be emptied in the case of such a partial vacuum by flowing upwardly through the pipe (11). There is no such valve in the defendants' apparatus and no such valve in the Roy apparatus.

Q. How about the bracket (14) and the yoke (15), which are shown in the Mouat patent? A. The bracket (14) is shown on the left-hand side of figure 3. It is a portion of the receptacle (6) and it affords a support for the stem (15) which carries the yoke (16), in which is journaled the cross pipe (18), and by reason of 91 that bracket and the nuts (15-A), which are also shown in figure 3, the entire bracket can be raised and lowered for the purpose of determining normally the desired pressure of the system. There is no such bracket or yoke either in the defendants' apparatus or in the Roy patent.

Q. How about the part which is marked (34) Mouat patent, shown on the left of figure 3? A. 34 is a flexible pipe which connects the lower portion of the receptacle (6) with the rocking pipe (18), which rocks in the yoke (16). There is no such specific construction either in the defendants' apparatus or in the Roy patent.

Q. How about the float valve (28)? A. I think that is the valve stem (28). The valve is (29) and the float is (30). That is a particular organization in the Mouat patent to prevent the water supply to the bulb from escaping through the open vent (26), in the event that the bulb should be entirely filled with water, and there is no such contrivance as that either in Roy or in the defendants' apparatus.

Q. How about the lever and the extension (22) thereof, shown in figures 1 and 2? A. In the Mouat patent the pipe (20) and its extension (22) constitute a lever which is pivoted in the center on the pipe (18), or connected with the pipe (18), which turns in the yoke, and on opposite sides of the center of oscillation are connected the two chains (25) and (26), which go to the different dampers of the furnace. There is no such construction as that either in the defendants' apparatus or in the Roy patent.

92 Q. Do you find these parts specifically described and referred to in the Mouat patent? A. Yes.

Mr. Sturtevant: That is all.

Cross-examination.

By Mr. Brock:

Q. In defendants' device, there is a spring, is there not, connected with the regulating bulb? A. Yes.

Q. Is not this spring the mechanical equivalent of the counterweight lever of the Mouat device? A. It is the governing weight. The same sort of requirement.

Q. Is it not for the purpose of returning the bulb to its normal position? A. Yes.

Q. Did I understand you to say that there was no connection with the air in the Hutchison system? A. In the Hutchison system?

Q. Yes. A. No, there is a connection with the air.

Q. Did I understand you to say that there was no connection with the air in the Mouat system? A. You mean the heating system?

Q. No; I mean in the regulating portion of it. A. The only connection with the air is through that opening in the top of bulb (21).

Q. Then there is through that opening a direct connection with the air? A. Yes.

Q. And in the Hutchison system there is a connection
93 with the air through the vent pipe? A. That is right.

Q. In the Roy patent the receptacle (17), as I understand it, is a closed receptacle? A. When in use.

Q. Do you know of any reason why the Mouat could not use a closed receptacle also? A. No; I do not see any adequate reason why it could not be designed so it could be—following the Roy disclosure.

Q. The Roy patent, as I understand, is a high pressure device, is it not? A. The patent does not say that it is high pressure, or anything about the pressure, but there seems to be sufficient pressure to work the diaphragm 4.

Q. Then, as I understand this answer, it will be impossible to utilize this Roy construction for the purpose of indicating one ounce difference in pressure? A. I think it might be designed so as to work on one ounce pressure.

Q. But there is nothing in the patent which will teach you how it might be designed, is there? A. It is simply a question of the diaphragm and the amount of work which the diaphragm is called upon to perform. The lever (5) in such case would have to be weighted so as to simply offset the one-ounce of pressure, and the valve (6) would have to be one which could be operated by a similar pressure.

Q. In other words, there would have to be a material alteration? A. I do not know. That depends entirely upon the proportions of the parts, and there is nothing in the patent to indicate what those proportions are.

94 Q. And there is nothing to indicate how those parts might
be dispensed with and still have an operative purpose? A. No, except to leave the bulb (17) open at all times; that is, if the valve (18) should be left open at all times, then it might work.

Q. This patent to Roy has a valve (6), a steam actuated valve, has it not? A. Yes.

Q. This steam valve is an essential part of the Roy apparatus, is it not? A. Yes.

Q. The device as shown would not be operative without this steam valve? Is that not a fact? A. Yes.

Q. No such valve as this is shown in the Mouat construction, is there? A. No.

Q. There is no valve at all in the Mouat construction? A. There is no valve in the steam pipe.

Q. That is what I mean—no valve in the steam pipe? A. No.

Q. Is it not your opinion that there is always ample condensation in the Mouat device to maintain a constant level in the receptacle 6? A. I should think so. If the specific proportion shown in the drawing should prove to be inadequate I would extend the pipe (11) so as to furnish an ample condensing surface.

95 Q. Do you not think there would be ample condensation irrespective of the length of that pipe 11? A. I should question it very much, especially in view of the teaching of the patent that that pipe 11 is present.

Q. Yes; that pipe 11 is present, but are you not of the opinion that that cast iron receptacle 6 would provide ample condensing surface? A. Certainly the patent contains no such suggestion, but whether or not——

Q. (Interrupting.) But from your familiarity with heating devices is it not your opinion that there would be sufficient condensation there? A. I do not think so.

Q. In this patent to Roy, do you find a receptacle which has a pipe extending above the bottom of the receptacle and having communication with the water space of the boiler? A. Yes; except the pipe to 11 does not communicate directly with the water space of the boiler, but with the steam space of the boiler.

Q. With the steam space but not with the water space? A. Not directly with the water space.

Q. Do you find in this Roy patent a receptacle in which the
water is maintained at a constant level regardless of the water in
the boiler, but having a pipe extending from the upper portion of
the receptacle to the steam space of the boiler, and the second pipe
extending from the water space of the boiler to a point above the
bottom of the receptacle? A. No; because there is only one
96 pipe in Roy which serves as a steam supply pipe and as the
overflow pipe.

Q. In the patent Shurtleff the bulb I connects with the steam pipe through the flexible pipe N, does it not? A. Let me find Shurtleff.

(After a pause.) The stenographer repeated the question as above recorded.)

A. Not normally, but only very exceptional circumstances.

Q. When this bulb I drops the valve O is opened, is it not? A. If it drops to the maximum extent. May I explain that to your Honor?

The Court: Yes.

The Witness: Your Honor will notice upon reference to Fig. 2 that there is an enlargement at O in the upper portion of Figure 2, and that enlargement contains a valve which is ordinarily closed. That valve extends through the casing O and has a lever arm P connected with it, and that lever arm has a loose connection with the upper end of the rod R. Ordinarily that valve is closed, but in the event that there should be a continued rise of temperature in the furnace after the dampers had been properly actuated so as to fill the bulb "I" to the maximum extent, then the enlarged head *r*, at

the extreme top of the rod "R", will act upon the end of the lever P, move it downwardly, and open the valve O, and permit the steam to blow off through the pipe F′ through the condensing radiator C shown in the Figure 1, and hence through that radiator, and the pipe H to the chimney flue. So that in case of a dangerous
97 rise of pressure in the system that valve will be opened and the steam will pass off to the flue.

By Mr. Brock:

Q. If the bulb I starts to descend is there anything to arrest its movement, will it not continue to move downwardly and open the valve? A. It is weighted by the weight L, and it will continue to move downwardly until the button R should encounter the valve stem P, and then if there is sufficient water thereafter that enters the bulb I the weight would be sufficient to move the stem P, and so open the valve.

Q. Will the bulb I start to move down until it has counterbalanced the weight L? A. No.

Q. Then having started to move down, is there anything to stop it? A. The only thing to stop it would be the friction of the valve.

Q. But the valve will be opened, will it not? A. Yes. I judge from the specifications, from what it says, that it is the intent to open that valve each time that it descends.

Q. Then if the valve is opened, what will happen to the water in the bulb? A. When that valve is opened the water in the bulb is being acted upon by the steam pressure on two sides, that is to say the steam pressure in the boiler is elevating the column of water E, and a very small portion of the steam pressure is acting upon the water in the bulb. As that steam is passing the valve is vented through the condensing radiator C, and I should think the pressure would be so far less that it would have no substantial
98 effect on the water in that Bulb I.

Q. Do you regard the Shurtleff device as an operative structure? A. Yes.

Q. Is it not a fact that the radiator C maintains the steam pressure in the system in this Shurtleff patent? A. No, the purpose of the radiator C, which is open to the atmosphere, is to act as a condenser, and to prevent the maintenance of any steam in the pipe F′ after the valve is opened. In fact that radiator C is always, through the pipe F′, in communication with the return pipe E, bringing back the water of condensation from the rest of the system, and that water of condensation operates more readily by reason—and any pressure in the system is prevented by the fact that it is open through the condensing radiator C to the open air.

Q. In the Broomell patent, 717,335, is there shown any receptacle in which the water is maintained at a constant level regardless of the level in the boiler? A. No, the water in the receptacle or chamber B rises and falls with the pressure in the boiler.

Q. Do you find any receptacle shown in this patent of Broomell which has a connection with the steam space of the boiler and also connection with the water space of the boiler? A. No, it has connection only with the water space of the boiler.

No redirect examination.

99 The prior art patents referred to by witness Wadsworth were also offered in evidence as follows as defendants' exhibits. Enlarged photograph of the "Plaintiff's Exhibit Number Two," sertain parts being in section, same being "Defendants' Exhibit Number One." Certified copy of the file wrapper and contents of the Mouat patent in suit, "Defendants' Exhibit Number Two." The Roy patent 632,671, "Defendants' Exhibit Number Three." The Broomell patent 650,778, "Defendants' Exhibit Number Four." The Broomell patent 717,335, "Defendants' Exhibit Number Five." The Dietrich patent 704,623, "Defendant's Exhibit Number Six", and the Shurtleff patent, 781,467, "Defendants' Exhibit Number Seven." The colored drawings of the respective patents as well as of the Mouat patent in suit, which were referred to by witness Wadsworth in his testimony, were offered in evidence as "Defendants' Exhibit Number Eight."

*"Plaintiff for Rebuttal Testimony."*

Plaintiff's expert witness WADSWORTH was recalled in rebuttal on behalf of plaintiff and testified that he did not agree with all of the statements of Mr. Brown, defendants' expert witness, regarding the operation of the device illustrated in the Roy patent, number 632,371. Wadsworth said:

"The Roy damper regulator depends primarily upon the control of the admission of live steam to the movable receptacle (17), that admission being determined by the action of the pressure-actuated diaphragm device which opens or closes a valve that is placed in the steam line leading from the boiler to the receptacle (17).

100 Referring particularly to the construction of figure 3, it will be noted that the steam line (2) which leads upwardly from the steam space in the boiler is provided with a valve (6) that controls the flow of live steam to and through the pipe (2′) that communicates with the upper portion of the receptacle (17).

It will be further noted that this valve (6) is controlled in its movements by a pressure-actuated diaphragm device that is indicated by the reference numeral (4) in figure 1 of the Roy drawings. When the pressure of steam in the boiler is normal—that is to say, when it is at the pressure normally desired in the heating system—this valve (6) is opened and live steam is flowing into and filling the bulb (17). The presence of this live steam in the bulb (17) prevents any admission of water to that bulb, and the bulb remains in its elevated position, as shown in figure 3, in which position the dampers of the furnace are open, so as to permit of the consumption of fuel to the extent required to maintain the normal steam pressure.

Now, is the pressure of the steam rises above the normal, the diaphragm device is actuated to close the valve (6) and prevent any further flow of steam to the receptacle (17). Under those conditions the steam in that receptacle will gradually condense and form a partial or complete vacuum in the bulb, depending upon the extent of the condensation. When that complete or partial vacuum is thus formed, water flows upwardly into the bulb through the pipes (10″) and pipe (10′), and it matters not where the supply of water that passes through that pipe comes from, because when the vacuum is formed in bulb (17), water will be forced into that bulb by atmospheric pressure alone, even if there is no steam pressure above the receptacle that contains the supply of water.

101 The Roy patent makes it very clear that the receptacle which contains the water, and the receptacle from which the pipe (10″) leads, may be either the boiler receptacle itself or it may be a separate receptacle such as is indicated by (43) in figure 3. As a matter of fact, it might be a receptacle that had no communication whatever with the boiler. The pipe (10″) for example, might lead down into and below the water space at one side of the boiler, and the device would operate in precisely the same way as it does when the pipe leads down into the water itself or leads down into the separate receptacle. The reason for that is, as I have already explained, that the water is forced up into the receptacle (17) only when there is a partial or complete vacuum formed in the receptacle by the condensation of the steam that was admitted to it in the normal operation of the device.

The receptacle (17) must necessarily, because of this principle of operation, be a closed receptacle; that is, one in which steam is trapped and confined, and to which no atmospheric air is admitted.

Now, further in respect to this operation of the Roy Device. It does not matter how far the receptacle (17) may be located above the water supply, because when steam condenses completely, it forms a complete vacuum, and when a vacuum is formed at the top of a water column, the water will rise in the containing receptacle to a maximum height of nearly 33 feet, and it will be forced up to that height, as I said a moment ago, by atmospheric pressure alone, regardless of whether there is any steam pressure on top of the water in that receptacle or not. In consequence of that, it is a matter of entire indifference to Roy as to what variation there may be
102 in the water level in the boiler, and it is further a matter of entire indifference to him as to whether such a separate receptacle as (43) is filled with water to a fixed level or not. The apparatus will work perfectly well, as Roy himself indicates in his specifications, if there is only enough water in the receptacle (43) to provide for filling or partially filling bulb (17); that is to say, the level of the water in receptacle (43) may be up to the level of the top of the drain pipe, or it may be away below that level, provided only that there is enough water there to fill the receptacle, when the vacuum is formed by the condensation of steam, the condensation operation of the Roy apparatus will be secure.

Now, what is the purpose of using this separate receptacle (43), as

shown in figure 3 of the Roy drawings? Why, the purpose of it is completely explained in the specification in the paragraph beginning with line 118, page 3 of the specification. That receptacle is provided solely and simply for the purpose of obtaining clean water where the boiler water itself is more or less dirty. The water that is in the receptacle (43) is water of condensation, which has been obtained by the condensation of the live steam admitted to the receptacle (17), and such water of condensation is, of course, absolutely free from sediment, which will tend to clog any of the various communicating pipes that lead from the water containing receptacle to the movable receptacle (17). Now, the provision of clean water for actuating the Roy Device is an important consideration for this reason. There is nothing in the Roy Device that determines the amount of water that shall be admitted to the receptacle (17); that is to say, the condensation of the steam in receptacle (17), after
the valve (6) has been closed, may be more or less complete,
103 with resultant formation of a more or less complete vacuum.
If that condensation takes place quite rapidly, as it will when the surrounding air is cold, and the steam pressure used is relatively high, the vacuum formed will be more complete than it will under the reverse conditions.

Now, it may easily happen that the vacuum is so complete that the bulb (17) will be completely filled with water, and in that case the water will flow up into the steam admission outlet from the pipe (2′), and it may flow back through that pipe into the connecting passages that form a communication between that pipe and the pipe (2). If it does that, and if the water condenses any sediment, the pipe and the connecting passages are likely to be so clogged that when live steam is again admitted to those pipes by the opening of the valve (6), the water and sediment that has been collected therein will not be blown out by the steam pressure, and in that case the device becomes absolutely inoperative. There will be difficulty of that sort even if pure water is used, because when a pipe as small as the pipe (2′) and containing as many bends as are found between the end of that pipe and the pipe (2), it will be exceedingly difficult to clear those tortuous passages from water that has once filled them. That is a difficulty Roy will encounter in the operation of his device, at times at least.

Now, there is one other difficulty that I may call attention to in connection with this Roy apparatus, and that is the difficulty that results from the slow action of the movable bulb (17). As I said a moment ago, the condensation in that bulb will be relatively rapid
when the surrounding air is cold, and when steam at certain
104 pressures is used, but if the surrounding air is warm, and if
steam at low pressures is used, the condensation in that bulb will go on quite slowly, and as a result of that the action of the apparatus will be very sluggish, because no water can be admitted to the bulb (17) until after there has been an overflow condensation of the fluid steam therein. So that there will be a considerable length of time elapsing after the valve (6) has been closed by an excessive steam pressure before the bulb (17) will become filled with water,

and will descend to actuate the damper of the furnace. During all of that interval, of course, the steam pressure will go on continually rising in the boiler. That sluggish action will be most pronounced, as I say, when the surrounding air is warm, and when no steam pressures are carried, and that unfortunately is just the time when the regulation ought to be most rapid, because that is the time when the least steam is required in the steam heating system. I am referring now, of course, to times in the fall and spring of the year, when as I say the surrounding atmosphere *in* much warmer than it is in the winter months.

There is also the matter to which I referred in my previous testimony, that has to do with the difficulty of controlling any variations in steam pressure by the use of a pressure-actuated diaphragm device. Those diaphragm devices, as I said, will operate fairly well with relatively high steam pressures where the variation in pressure is sufficient to overcome the resistence of the diaphragm to movement, but where we are concerned with the close regulation of small steam pressures, diaphragm devices are very ineffective and very inefficient. I might say that I have had some twenty-five years'
105 experience in various branches of steam engineering, and for the past six or seven years I have been consulting engineer of two of the largest hotwater heating companies in the United States, and I have had a long experience with various forms of these diaphragm control devices, so that I speak from practical experience and not as a matter of opinion.

I would add, in referring to this last difficulty, I have reference to the ineffectiveness of the diaphragm device (4) which is provided by Roy for the control of his steam valve (6), when any control of low steam pressures is in question. The valve (6) of the Roy Device is actuated solely and entirely by the movement of the diaphragm in the diaphragm casing (4), and any failure of the diaphragm to act will of course prevent the necessary action of the valve (6), and if the valve (6) does not act the entire Roy apparatus becomes inoperative."

Wadsworth was then asked what he had to say regarding the Broomell patent number 650,778, and testified as follows.

"Broomell effects the movement of his damper regulator by the rise and fall of a float (L) that is mounted in a chamber (G). This float and chamber construction is best shown in figures 2 and 3 of the Broomell patents. The chamber (G) is designed to receive all of the water of condensation which flows back from the radiators in the house system, and it is provided further with a pipe (G-2), which leads downwardly from the bottom of the chamber (G) to the water space in the boiler. Owing to this arrangement, the water in the chamber (G) is subjected on its top surface to whatever pressure of steam there may be in the return pipes (F) that lead down-
106 wardly from the radiators. If the steam is completely condensed in the radiators, then there will be no back pressure in the return pipes, because those return pipes will be sealed from the live steam in the radiators by the water of condensation itself, but it very frequently happens in the operation of radiator systems

that the steam is not completely condensed in the radiators, but passes through the radiators in part and passes back through the return pipes. In that case, there will be a certain amount of steam entering the top of the chamber (G).

Now, Broomell makes a special provision for taking care of that steam by the use of what he terms a condensing radiator (I), which is in communication with the chamber (G) through a pipe (H). Any steam that passes backward into the chamber (G) is supposed to pass upward into the condensing radiator (I), and if it is not completely condensed in the radiator, it passes upward through the pipe (H′) to the condensing chamber (I′) at the very top of the building.

When it is condensed in this condensing radiator (I), in the condensing chamber (I′), the water of condensation thus formed flows backwardly again into the chamber (G); but the important point to which I wish to call attention is this, that the top of the chamber (G) is not vented to the atmosphere. It is filled, as I say, with whatever steam may pass backwardly from the radiators, and the water in that chamber is therefore always subjected to the pressure of that uncondensed steam.

The water level in the Chamber (G) is determined by the balance of forces that are exerted by the steam pressure in the boiler itself, and the steam pressure of the uncondensed fluid in the top of
107 the chamber (G), and that level of water will therefore continually vary with every variation in the back pressure from the radiator, that is, will vary with every variation in the amount of condensation in those radiators.

Another thing: Even when all of the steam is condensed in the radiators and the top of the chamber (G) is therefore not subject to any back pressure from the radiators, the height of water in that chamber will vary, not only with the pressure of steam in the boiler, but also with the level of the water in the boiler, because the height of the water in the chamber (G) is determined by measuring the difference in level between the water in the boiler and the water in the chamber (G), and establishing such a difference in level in water column as corresponds to the steam pressure above the water in the boiler. I am afraid I have not made that quite clear. I will try and put it in a different way.

When the water in the boiler is subjected to a given steam pressure, as I say of two ounces, the water in the column (G-2) will stand at a height of three inches above the water in the boiler, because a three-inch water column just balances a two-ounce steam pressure. If the water level of the boiler falls, the height of the column in (G) will correspondingly fall, because there will always be the three-inch difference in level between the water in the boiler and the water in the column (G), when there is a two-ounce pressure in the boiler. So that the water level, as I say, in the pipe (G-2) and in the chamber (G) at the top of that pipe will, having a given steam pressure in the boiler, rise and fall with the water level in the boiler. In
108 consequence of that the position of the float in the chamber (G-2) will vary with the height of water in the boiler, even when the pressure of steam in that boiler may remain absolutely con-

stant. In consequence of that the position of the damper which depends upon the position of the float (L), will vary with the height of water in the boiler, and the damper may open or close with variations, of level in the boiler water, even when the steam pressure remains absolutely constant. That of course renders the apparatus entirely ineffective for the close regulation of steam pressure in the radiator, because when one radiator of the system is turned on there will only be a certain amount of water evaporated from the boiler, and the level of water in the boiler will only be effected slightly, but when there are ten radiators turned on, ten times as much water will be turned on for those radiators, and the level of the water in the boiler will correspondingly fall with the level of the water in the chamber (G), and as that falls the float (L) falls and the damper (M) will be closed, and it will be closed at a time when we need the greatest consumption of fuel; that is, at a time when there is the greatest demand on the system for the supply of steam.

That is the fundamental trouble, as I tried to explain in my previous testimony, with any device that attempts to regulate the steam pressure by the rise and fall of a water column that is directly connected with the water in the boiler, and it is because of that very difficulty that Mouat was forced to adopt this independent and auxiliary chamber, in which the level of the water remains constant, independent of any change of level in the boiler itself.

Then, as I said, in starting my discussion of the Broomell
109 patent, we have in this particular system the additional difficulty that the level of water in the chamber (G) will vary with the variation in the back pressure of steam flowing from the radiators. When that back pressure in the top of the chamber (G) increases, the water level will correspondingly fall, and that again will actuate the damper, even though there may be no change of pressure in the boiler space itself; that actuation will be affected solely by the variations in the flow of steam to the radiators of the house. That is another reason why the Broomell system of control is very ineffective and very disadvantageous."

Witness was then asked as to the Broomell patent number 717,335, and testified as follows:

"That is open to precisely the same objections, and presents precisely the same difficulties as the control apparatus of the earlier Broomell patents. In this connection I would like to call attention to one point in regard to which Mr. Brown is clearly wrong. He stated, if I recall his testimony correctly, that in this Broomell system of patent 717,335 we have what may be termed an open receptacle system; that is, a system in which there is no back pressure in the return pipes from the radiators. Now, it will be noted that Broomell in this patent, just as in the earlier patent, makes a special provision for taking care of uncondensed steam that flows back through what he terms his return water pipe (D). That provision is the provision of a condensing coil (E′), through which an uncondensed steam may pass, and in which it will presumably be condensed, but the very provision of that condensing coil establishes and maintains a back pressure in the return water pipe because of the resistence of the flow of
110 steam through that condensing coil. Then there is further evidence that Broomell did not consider his return system as

an open or vented system, in which there is no back pressure, and that is found in the provision of the trap, that is shown at the upper right hand corner of the receiver (B). It will be noted that that trap is provided with a vertically descending wall, marked (C), and the purpose of that vertically descending wall is to form what is termed the water seal, which prevents uncondensed steam from passing directly into the receiver (B).

Now, just one other point in regard to second Broomell system. If that depending wall (C) was of sufficient depth to always form a water seal of sufficient height, then no live steam could get back into the chamber (B), but it would have to be of much greater depth than is shown in the Broomell patents in order to effect that result, because with a back pressure of only one ounce of steam, the wall (C) would have to dip below the surface of the water at least an inch and a half in order to prevent the blowing of the water right past the edge of that partition, and the consequent readmission of the back pressure of the steam into the boiler (B) if such action did take place, as it would inevitably take place if the construction was such as is shown in the Broomell patent drawings, then the chamber (B) would be partially filled with uncondensed steam above the water level, and the top of that water would be subjected to the pressure of that uncondensed steam, just as it was in the Broomell apparatus, and the height of the water level in the chamber (B) would be determined by the difference in pressure between the steam in the boiler, and the uncondensed steam above the water, and would also be determined by the
111 variation in the water level of the boiler. Variations in both
of these factors which would be continually occurring in practice would make the position of the float (G) which controls the damper of the furnace an entirely indefinite and indeterminate one, and the regulation of the damper would vary continually with such variations in the water level of the boiler, and with such variations of the back pressure of steam returning from the radiator."

Witness then testified regarding the other patents offered in evidence by defendant as follows:

"Q. What have you to say regarding the pressure control device of the Shurtleff patent, No. 781,467? A. The control apparatus of that patent is absolutely inoperative. The reason for that is this. The movable receptacle (I) is connected at its top by the flexible pipe (N) with the pipe (F″), and this pipe (F′) is directly connected with the live steam pipe (F) which carries steam upward into the house radiators. Now, there is a valve (O) which is placed in this live steam pipe between the boiler space and the connection of the pipe (N), and whenever the receptacle (I) is depressed by the admission of an additional quantity of water to that receptacle, the lever arm (J) that carries the receptacle is moved downward to the extreme limit of its movement, and the valve (O) is opened. This admits live steam to the part of the pipe (F′) which is connected with the top of the receiver (I) and that live steam will immediately enter the receptacle (I), blow out all of the water in that receptacle, and allow the receptacle to immediately arise to its highest position, and thus

immediately open the damper to the fullest extent. This will
112 increase the fuel consumption in the furnace at the very time
when it ought to be cut down; that is, at the very time when
the steam pressure in the furnace is at the highest point.

Q. Please state what you have to say with regard to the pressure control device of the Deitrich patent No. 704,623? A. The control apparatus of the Deitrich patent is not open to the objection that attends the use of the control apparatus of the Broomell patents. That is to say, in the Deitrich arrangement, there is never any back pressure of steam in the pipes returning from the radiators, this being prevented by a special valve control which prevents any steam from flowing out of the radiators, and allows only condensed water to flow therefrom. But the Deitrich control is subject to the same objection as attends all controls where the attempt is made to vary the position of the dampers by the rise and fall of the water column that is directly connected to the water in the boiler. I do not need to repeat my statements as to that objection here.

Q. In these four patents which you have discussed, do you find a receptacle having connection with the steam and water space of the boiler, and in which the water in this receptacle is maintained at a constant level, regardless of the level in the boiler? A. No, I do not. That feature is not shown in any of these patents.

Q. Mr. Wadsworth, Mr. Zellers in giving his testimony yesterday,
referred to the fact that he had placed a level upon the pipe at the
bank installation, but that he had only measured it at one
113 point. You have testified that you have made an examina-
tion of this pipe and tested it. Will you please state whether
or not you tested it at more than one point? A. Yes; I tested it at several points, and moreover, I tested it at a time when there was no installating cover on it, so that the level could be applied directly to the pipe. I found that the inclination varied at different points in the pipe, being considerably more pronounced at some points than at others, but that the pipe as a whole sloped from the steam pipe connection toward the trap.

Q. Mr. Wadsworth, I find in Mr. Brown's testimony on page 69 of the typewritten record a statement to the effect that Mouat obtains his condensation by providing a long inclination of the exposed pipe (11), so that the steam will condense in the pipe (11) and be discharged into the receptacle (6) fast enough to compensate for the loss of water through evaporation. Will you please state your opinion regarding the amount of condensation that takes place in this pipe, and compare the same with the amount of condensation that will take place in the receptacle (6)? A. The only way I can do that is to assume that the patent drawings are made to represent more or less closely an actual installation. I find by the measurement of those patent drawings that they are drawn approximately to at least to a scale that would represent an actual every day installation. This scale I find to be about 16 to one. On that scale as applied to figure 1 of the Mouat patent, the boiler (1) would be about four feet six inches in diameter, and five feet high, and that is about the usual dimensions of a boiler that is used for an 114 ordinary dwelling house. On that same scale I find that the pipe (11) would be a three-quarter inch pipe, which would have an outside diameter of about one inch. I find further that the dimensions of the chamber (6) are about eight by 16 inches; that is, that the damper is about eight inches in diameter, and about 16 inches high. Using those figures, I find that the exposed area of the inclined portion of the pipe (11), which is about 44 inches long, would be, roughly, 138 square inches. I find that the exposed area of the vertical portion of the pipe (11) and of the surface of the trap chamber (6) would be altogether about 547 square inches. The exposed area of the inclined portion of the pipe (11) would therefore represent only about 20 per cent of the entire exposed area of the parts that would be cooled by the air, and would affect by such cooling the condensation of the steam contained therein. Roughly, therefore, there would be about four times as much condensation of steam in the vertical portion of pipe (11) and in the trap chamber itself as there would be in the inclined portion of pipe (11). I might say that in these calculations I have not taken any account whatever of the additional added cooling surface that is afforded by the various connections to the chamber (6). That added cooling surface that is presented by the bracket attachment and by the pipe connections and lever connections to the chamber (21), would very considerably increase the cooling of the walls of that chamber, and consequently increase the condensation of the steam in the chamber itself.

Q. Is the operativeness of the Mouat device in any way affected by an excess of water condensing into the trap or receptacle (6)? A. No, sir; no excess. It simply flows out through the overflow pipe (9) into the boiler.

115 Q. On page 89 of the typewritten record of Mr. Brown's deposition, I find these statements:

"But there is this important distinction between the defendant's apparatus and either the Roy or the Mouat patent, and that is in the manner in which the trap is kept full of water. In the Mouat — the trap is kept full of water solely by reason of the condensation of the steam in the communicating pipe (11), and that communicating pipe (11) is especially designed for the purpose of supplying water of condensation to the trap."

Further on in the page is this paragraph:

"But in the defendant's apparatus there is no problem presented of keeping the trap full of water, because through that trap passes all of the water of condensation from the entire radiating system in the building."

What have you to say regarding these statements of Mr. Brown's deposition? A. I cannot understand his second statement at all, because exactly the same problem is presented in keeping the trap full of water in defendants' apparatus as is presented in the operation of the Mouat apparatus. The proper operation of defendants' apparatus necessitates the maintenance of the water level in chamber (6) at a fixed determinate height, that is controlled solely by the position of the overflow pipe. Possibly Mr. Brown means that in defendants' apparatus it is not necessary to supply water to the trap by condensation in the pipe (11), because enough water comes through that trap from the return pipes (R).

116 By the Court:

Q. Both of these devices are dependent upon the maintenance of the water in the receptacle? A. Yes, sir, your Honor.

Q. I understood Mr. Brown to say that there were seven gallons a minute, or Mr. Hutchison, flowing through there in some way, and that it required only two gallons—is that right? Whereas the inference is that by the condensation as appears on pipe (11)—A. (Interposing.) I never have heard that assertion made, your Honor. There are any number of these Mouat devices in operation, and they are constructed in exact accord with the patents so far as the principle of construction is concerned, and they have always operated perfectly.

Q. There is one question I wanted you to speak *to* before you were through. A. There is certainly enough water of condensation in the Mouat apparatus to keep that level at the required height, and the probability is that there is a considerable excess of condensation in the Mouat apparatus that is taken off by the overflow pipe (9). Naturally, in the design of this apparatus, sufficient condensing surface would be provided in this chamber to always supply more than enough water of condensation, so that you would always be on the safe side. Now, when you have supplied enough water of condensation to keep that level at a fixed point, it does not matter how much more you supply. Any additional quantity could be supplied, and it will simply flow off through the overflow pipes. An excess of condensation does not affect the operation of the device in
117 any way, shape or manner, and in the use of defendants' device that is true. Water may pour over from this overflow pipe continually in defendants' device, but as long as this level is maintained at a fixed point, the operation of the system is precisely the same as the operation of the Mouat system. In other words, the excess of water of condensation passing through that trap cuts no figure at all in the operation of the device.

Q. Of course not, but the deficiency of the water of condensation would? A. Yes, sir. If there was not enough water of condensation to maintain that level constant, then the device would not operate properly, but that difficulty has never been present in the actual operation of the Mouat installations, so far as I know. No complaints of that sort have ever been made.

By Mr. Brock:

Q. In Mr. Brown's deposition on pages 92 and 93 of the typewritten record, he refers to the part (10) as being a check valve, and the part (37) and a venting valve, in the part (14) as being a bracket. Are any of these parts involved in the normal operation of the Mouat pressure re-sulating device? A. No. It was for that reason that — omitted them in the large sketch.

Q. I think probably you have touched upon this point, but to make sure of it, I will ask you what you have used as a diaphragm control of pressures as small as one ounce? A. Well, I could possibly make the difficulties that are encountered in this con-
118 nection clearer by presenting a sketch of an ordinary diaphragm control. (The witness here draws a sketch.)

An ordinary diaphragm control device consist- simply of a sheet of material that is placed between the two halves of a chamber in the manner indicated in the sketch which I here present. The lower part of that chamber is filled with the fluid that forms the actuating medium for the diaphragm, and the diaphragm is attached in some manner on its upper surface to the device that it is desired to move by the action of the fluid. Now, it has been found in practice that ordinary vegetable material, such as sheet rubber, for example, cannot be used for these diaphragms, where they are subjected to steam pressures, or in fact where the control device is to be used for long periods of time, without particular attention. The only material that can be used under such conditions is some form of sheet metal, either sheet copper or sheet steel. Those sheets of metal present great resistance to movement out of the normal plane of the diaphragm, because the diaphragm is clamped all around the edges tightly to make a tight joint between the two halves of the chamber, and the diaphragm can only move out of that normal position by an actual stretching of the metal itself. That stretching of the metal requires the action of very considerably pressures, and for that reason the diaphragm control device is only suitable for securing movements of the control device when the pressures to which the diaphragm can be subjected are measured in pounds rather than in ounces.

Mr. Brock: Your honor, I offer this sketch in evidence as the sketch explaining the operation of the diaphragm. (The
119 sketch was thereupon marked Plaintiffs' Exhibit No. 10.)

By Mr. Brock:

Q. In the Roy patents, is there a diaphragm such as you have described disclosed? A. Yes. The control of the valve (6) which admits steam to the movable receptacle (17), or which catches any steam from that receptacle, is affected entirely by the movements of such a diaphragm as I have shown in my sketch.

Mr. Brock: That is all, I think, your Honor, on direct examination.

By the Court:

Q. Mr. Wadsworth, you say that there are many Mouat installations which you know of? A. Yes, your Honor. I know of a considerable number. I have not seen all of them by any manner of means.

Q. Do you know of any installations under the Roy patents? A. I do not, no, sir. I never saw that system in use.

Q. And of these other patents that are in evidence here? The
Broomell, the Shurtleff, or the Deitrich? A. No, sir; I have never
seen any installations of Broomell, but I understand that there are
installations. But I also understand that the difficulty that I have
referred to in connection with the Broomell patents, the difficulty
of exposing the top surface of the water in the chamber to the back
pressure of steam from the radiators, I understand that the
120 difficulty is obviated in actual Broomell installations by the
provision of such a control valve as Deitrich shows. So far
as I know, there are no installations of Broomell's that have been
put in in accordance with the showing of these patent drawings.

The foregoing record in narrative form is hereby approved and ordered filed and made a part of the record in the above case.

WILLIAM HITZ,
*Judge.*

December 27, 1917.

Endorsed on cover: District of Columbia Supreme Court. No. 3156. Hutchison Vapor Heating Corporation, et al., appellants, vs. Thomas G. Mouat. Court of Appeals, District of Columbia. Filed February 11, 1918. Henry W. Hodges, clerk.